GALILEO: POWER, PRIDE, AND PROFIT

THE RELATIVE INFLUENCE OF REALIST, IDEATIONAL, AND LIBERAL FACTORS ON THE GALILEO SATELLITE PROGRAM

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Abstract

GALILEO: POWER, PRIDE, AND PROFIT

This study is about the European navigation satellite program dubbed “Galileo” and its ability to date to survive in the face of many serious obstacles. It seeks to understand Galileo’s ability to survive by answering two basic research questions: 1) Did realist factors, liberal factors, or ideational factors weigh the most heavily on European decision-makers’ assessments of the need for Galileo? And 2) Are European decision-makers’ assessments of the need for Galileo being driven more by the international, European, national or industrial levels? This study weighs these factors and assesses the influence of these levels upon European decision-makers at key decision points in 1999, 2002, 2004, and 2007 in order to judge whether or not Galileo’s ability to survive may be attributed to changes in the comparative weight of these factors and levels over time.

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Acronym List

AECMA	European Association of Aerospace Industries
ARTES	Advanced Research in Telecommunication Systems
ASAT	Anti-satillite
ASI	Agenzia Spatiale Italiana (Italian Space Agency)
ASTRO+	Advanced Space Technologies to Support Security Operations
BNSC	British National Space Center
BOC	Besoins Operationels Communs
C3I	Command, Control, Communication and Information
CFE	Conventional Forces in Europe
CFSP	Common Foreign and Security Policy
CNS/ATM	Communication, Navigation, and Surveillance/Air Traffic Management
COR	Common Operational Requirements for a European Global System of Observation by Satellite
DG	Director-General
DG TREN	EC Directorate General for Transportation and Energy
DGA	Armament Procurement Agency (France)
DGPS	Differential GPS
DLR	German Aerospace Research Center
DoD	Department of Defense
DoT	Department of Transportation
EC	European Commission

ECAC	European Civil Aviation Conference
ECU	European Currency Unit
EDA	European Defense Agency
EEC	European Economic Community
EGAS	European Guaranteed Access to Space
EGNOS	European Geo-stationary Navigation Overlay Service
ELDO	European Launch Development Organization
ESA	European Space Agency
ESC	European Space Council
ESDP	European Security and Defense Policy
ESRO	European Space Research Organization
ESS	European Security Strategy
ETG	European Tripartite Group
EU	European Union
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EUROCONTROL	European Organization for the Safety of Air Navigation
EUSC	EU Satellite Center
EUTELSAT	European Telecommunications Satellite Organization
FP7	2007-2013 EU *Financial Perspective*
GDP	Gross Domestic Product
GJU	Galileo Joint Undertaking
GLONASS	Global Orbiting Navigation Satellite System (Russian)
GMES	Global Monitoring for the Environment and Security

GNP	Gross National Product
GNSS-1	Global Navigation Satellite System - 1
GOC	Galileo Operating Consortium
GPS	Global Positioning System
GSA	GNSS Supervisory Authority
HLD	High Level Definition
ICAO	International Civil Aviation Organization
IGO	Intergovernmental Organization
ILS	International Launch Service
IMO	International Maritime Organization
INMARSAT	International Maritime Satellite Organization
IO	International Organization
IOV	In-Orbit Validation
ISS	International Space Station
ITU	International Telecommunications Union
JTF	ESA/EC Joint Task Force
MOU	Memorandum of Understanding
MNC	Multi-national Corporations
NRO	National Reconnaissance Office
OS	Open Service
OSD	Office of the Secretary of Defense
PNT	Positioning, Navigation, and Timing
PPI	Public Private Initiative

PPP	Public Private Partnership
PPS	Precise Positioning Service
PRS	Public Regulated Service
R&D	Research and Development
R&T	Research and Technology
SA	Selective Availability
SAG	Space Advisory Group
SAR	Search and Rescue
SIAC	Single Intelligence Assessment Capacity
SLBM	Submarine Launched Ballistic Missiles
SoL	Safety-of-life
SPS	Standard Positioning Service
SSA	Space Situational Awareness
SSC	Spectral Separation Coefficients
SSTL	Surrey Satellite Technology Limited
STAR 21	*Strategic Aerospace Review for the 21st Century*
TENS	Trans European Networks
WEU	Western European Union
WAAS	Wide Area Augmentation System
WRC	World Radio Conference
WTO	World Trade Organization

Part I: Orientation

Chapter One:
Overview

This study is about the European navigation satellite program dubbed "Galileo" and its ability to date to survive in the face of many serious obstacles. Galileo represents much more than a satellite system. Today, it is Europe's most important high-technology project.[1] It is the European Union's first attempt to lead the complete development of a critical technological infrastructure which will span the European Union and the globe. These aspects make Galileo significant internationally, within the European Union, and within the European Union's Member States.

This dissertation seeks to determine if changes in the motives driving Galileo have helped Galileo to avoid program cancellation. A chronological study of the Galileo program examines decision points in 1999, 2002, 2004, and 2007. This examination reveals the presence of various factors that influenced European decision-makers at these points in time. The factors are categorized as realist, liberal, or ideational and their significance is subjectively weighed. The study examines evidence of shifts in the relative weight of these factors on European decision-makers and a subjective judgment is made about their significance.

The influence of realist factors is indicated primarily by the importance of military or defense organizations, the significance of military or defense sources of money, and the decision-making authority of military or defense officials over the Galileo program. Realist indicators also include expressions of policy by key European

[1] The Federal Ministry of Transport, Building and Urban Affairs, Press Release, "Tiefensee: Galileo is an Important European Project," May 17, 2007. http://www.bmvbs.de/en/Transport/Aviation-,1897.996936/Tiefensee-Galileo-is-an (accessed February 11, 2008). Wolfgang Tiefensee was the EU Transportation Council President in 2007.

decision-makers on Galileo which convey that power is the most important tool to insure European security.

In contrast, the relative significance of liberal factors are indicated primarily by the level of involvement and control of the Galileo program by civil or commercial organizations, the significance of civil or commercial sources of funding for Galileo, and the decision-making authority of civil officials or commercial leaders. Liberal indicators also include expressions of policy by key European decision-makers which point to Galileo's importance for international cooperation, efficiency, cost effectiveness, economic well-being, and as a public good.

Ideational motives are indicated primarily by evidence which shows that identity considerations, especially ideas about European pride and prestige overrode realist and liberal motives.

In addition, this study considers the relative influence of the international, European, national, and industrial levels. The national level includes an examination of French, German, Italian, and the United Kingdom perspectives on Galileo.

This method helps improve the understanding of the Galileo program. It provides a subjective judgment that shines light on the significance of the many motives driving the Galileo program and improves our ability to anticipate Galileo's future.

1. Galileo's Challenges

It has not been smooth sailing for Galileo. First approved by the European Union in December 1994, Galileo has faced many serious obstacles at the international, European, and national levels and is still many years away from operation.

At the international level, the United States initially opposed the development of Galileo for economic, military, and political reasons. Economically, the United States perceived Galileo as competition to the United State's Global Positioning System's (GPS) monopoly on commercially profitable satellite navigation applications. Militarily, because satellite navigation applications are critical enablers of many modern military capabilities, the loss of the U.S. monopoly and control of global satellite navigation signals made Galileo a potential threat to the U.S. military. Politically, the United States perceived Galileo's autonomous capabilities as potentially weakening the NATO alliance.

At the European level, Galileo faced (and still faces) hurdles due to questions about its purpose, the need for it, the sources of its funding, its potential commercial profitability, the distribution of lucrative development contracts, its security implications, and fragmentation of control over the project between the European Commission (EC), the European Space Agency, and other institutions.

At the national level, conflicting priorities among France, Germany, Italy, the United Kingdom, and smaller European space actors seemed to doom Galileo, until recently, to the scrap heap of failed European collective projects.

But despite all, Galileo survives. Why? This study hopes to provide a preliminary answer to this puzzle.

2. The Significance of Navigation Satellites

The military, economic, and political significance of navigation satellites grew rapidly between 1989 and 1994 in the wake of the launch of the U.S. Air Force's 24 satellite

Global Positioning System.[2] GPS is a dual-use system, but its military purposes take priority. It is beyond the scope of this study to discuss in depth the technical characteristics of GPS navigation satellites; those details include how the orbits of the 24 satellites in the GPS constellation enmesh the globe while each satellite continuously broadcasts extremely accurate, synchronized timing signals; how the ground control stations continuously monitor signal quality and interact with the satellites to fine-tune the system; and how GPS receivers get timing signals from four satellites in order to enable the software to convert the signals, using triangulation, into extremely accurate positioning, navigation, and timing (PNT) information. The result is that GPS is the preeminent global source of PNT data for military and nonmilitary applications.[3] In addition to the positioning and navigation services GPS is renowned for, GPS is also the world's "global clock" which is used to synchronize the timing, to within a few billionths of a second, of modern telecommunications systems and other systems and networks.[4] In essence, GPS serves as the traffic cop on the global information highway.

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[2] The predecessor to GPS, the U.S. Navy Navigation Satellite System, "Transit," was operated by the U.S. Navy from 1964 to 1996, providing navigation data to Navy submarines and shipping, and from 1967, to commercial shipping and aircraft of all nations. Its design goal was to be accurate within a few hundred feet. By the 1970's its civilian use far exceeded its military use. Robert J. Danchik, "An Overview of Transit Development," in "The Legacy of Transit," *John Hopkins APL Technical Digest* 10, no. 1 (1998): 25. http://techdigest.jhuapl.edu/td1901/index.htm (accessed October 15, 2007).

[3] Although funded, operated, and maintained by the U.S. Air Force, GPS is managed by the National Space-based PNT Executive Committee which is chaired jointly by the deputy Secretaries of Defense and Transportation. The Committee's members include equivalent-level officials from the Departments of State, Commerce, Homeland Security, and Interior, the Joint Chiefs of Staff, and NASA. The National Space-based PNT Executive Committee was establish by Presidential Directive on December 15, 2004 and replaced the Interagency GPS Executive Board (IGEB) which oversaw GPS Policy from 1996-2004. U.S. Space-Based Positioning Navigation and Timing National Executive Committee, "U.S. Space-based Positioning Navigation and Timing Policy: Fact Sheet," December 15, 2004. http://pnt.gov/ (accessed November 12, 2007).

[4] Lt Gen Bruce Carlson, "Protecting Global Utilities," *Aerospace Power Journal* 14, no. 2 (Summer 2000). http://www.airpower.maxwell.af.mil/airchronicles/apj/apj00/sum00/carlson.htm; (accessed August 15, 2007).

Operation Desert Storm in 1991 introduced the world to the military significance of GPS[5] and by 1996 GPS signals were being embedded into virtually every major U.S. weapon system. No doubt, GPS gives the United States a substantial military advantage.[6]

The economic importance of GPS was also recognized in the 1990s. By 1996 civil and commercial uses of GPS signals were quickly becoming part of the global information infrastructure.[7] The demand for commercial GPS receivers and GPS-based applications grew into a multi-billion dollar a year global industry. Somewhat unexpectedly, the precise timing information transmitted by GPS satellites was quickly incorporated into many inventive applications that are not related to navigation. By 2000 it was already recognized that the "Loss of GPS timing could disable police, fire, and ambulance communications around the world, disrupt the global banking and financial system, which depends on GPS timing to keep worldwide financial centers connected, and interrupt the operation of electric power distribution systems."[8] The incorporation of GPS timing signals into critical civil and economic infrastructures across the globe demonstrates the importance of GPS to a broad range of economic activity. In fact, GPS has become so important to the worldwide economic infrastructure that it is considered a "global utility" whose multi-use services are integral to the United States and many other countries' economic growth, transportation safety, and key components of multiple

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[5] Scott Pace et al., *The Global Positioning System: Accessing National Policies* (Santa Monica: RAND, 1995), 247. http://www.rand.org/pubs/monograph_reports/MR614/MR614.appb.pdf accessed November 12, 2007)

[6] Presidential Decision Directive/National Science and Technology Council-6, "*US Global Positioning System Policy*" (March 28, 1996).

[7] Ibid.

[8] Commission to Assess United States National Security Space Management and Organization, *Report of the Commission to Assess United States National Security Space Management and Organization Pursuant to Public Law 106-65,* Chairman Hon. Donald H. Rumsfeld (Washington DC, January 11, 2001), 23.

sectors of critical infrastructure.[9] The Netherlands Economic Institute calculated that if GPS failed for just two days, the European transport sector alone would experience 220 million euros in losses.[10]

The political benefits of GPS to the United States derive from the military and economic benefits outlined above. For example, GPS enables the U.S. military's vaunted ability to strike a target precisely anywhere on earth, creating a revolutionary military capability and a credible military deterrent. Economically, the United State's unilateral control of GPS and the extent to which GPS has become embedded in global economic infrastructures provides the United States with a potentially very powerful lever in international affairs.

It is no wonder than that European, Russian, and Chinese decision-makers have decided to develop their own autonomous navigation satellite constellations.[11] The United States, Russia, and China navigation satellite systems are military-controlled indicating strongly the strategic nature of global navigation satellite capabilities. Europe, on the other hand, has chosen to develop and operate Galileo as a civilian satellite navigation system under civilian control rather than as a military satellite system. Does this imply that the civil and economic benefits of Galileo really take precedence over its benefits to European security, or does it signal that the only way for European decision-makers to achieve the political consensus needed to begin the Galileo program was to

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9 *U.S. Space-Based Positioning, Navigation, and Timing Policy*, December 15, 2004.
10 The Federal Ministry of Transport, Building and Urban Affairs, News Release, "Galileo – the European Satellite Navigation System," http:/www.bmvbs.de/en/EU-Council-presidency/Programme-of-work-,2709/Galileo.htm (accessed February 11, 2008).
11 The Russian military operates and is improving their Global Orbiting Navigation Satellite System (GLONASS) which began development in 1976 and began operating in 1993. GLONASS does not currently have the accuracy to affect military operations to the extent GPS has, and is not competitive commercially with GPS. China's Beidou satellites provide limited regional capabilities. Rosalind Lewis and others, *Building a Multinational Global Navigation Satellite System: An Initial Look*, (Santa Monica: RAND, 2005). 12.

obscure its military and political significance by framing it as purely a civilian program? This study will help us to begin to find the answer.

3. Literature Review

Political scientists have been slow to recognize the significance of this first, so-called "global utility" and have neglected to closely examine its implications.[12] Likewise, the European Union's new leadership role in space has received little in-depth attention. This dissertation is an attempt to begin to fill those gaps by closely examining the European effort to create an autonomous PNT capability, determine what political, economic, and security considerations are likely driving it, and improve our understanding of its implications.

Many studies have looked closely at the overall significance of the American space program. These studies have taken a variety of perspectives including political, economic, social, military, intelligence, technological, power, and historical viewpoints (Burrows, Hays, Johnson-Freese, Lambakis, Logsdon, McDougall, Oberg, Pace, Sadeh, Van Dyke). But relatively few studies have looked at the European space sector in itself or from a U.S. perspective. Those studies that do consider the European space sector usually focus on cooperative space efforts within Europe, or the sometimes difficult cooperative space efforts between Europe and the United States. The story of the European Space Agency often takes center stage with its organizational achievements

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[12] A global utility is defined as civil, military, or commercial systems – some or all of which are based in space-that provide communication, environmental, position, image, location, timing, or other vital technical services or data to global users. Carlson, "Protecting Global Utilities." Peter Hays discusses the difficult issues surrounding the control, regulation, and protection of global utilities in Peter L. Hays, *United States Military Space: Into the Twenty-First Century*, INSS Occasional Paper 42, (Maxwell Air Force Base, Alabama: Air University Press, September 2002), 130.

and pathologies, and its scientific triumphs and disappointments. (Madders, Suzuki, Zabusky). In its "History Studies Reports," ESA itself has provided many useful and comprehensive historical studies on the history of the European Space Agency.[13] Tellingly, the 2000 ESA publication, *A History of the European Space Agency, 1958-1987* notes that "Little has, in fact, been written on the European space effort."[14]

The Galileo program has not been totally ignored, however. Participants and observers of the Galileo project have suggested a variety of motives for its development. In 2001, the European Commission presented the arguments for Galileo in four categories: Political, Economic, Social, and Technological. Political arguments for Galileo include European independence, sovereignty, and industrial politics. Economic arguments include global market share, global competitiveness, employment, and the efficiency of the transport industry. Social arguments include better and new services for citizens, improved safety of transport systems, and environmental benefits. Technological arguments include achieving a technological lead for European industry, and exploring technology synergies.[15] For many years ESA has simply asserted that European independence was the chief reason for Galileo.[16] L. Cucit and others in "Management and Organizational Models of the European Space Agencies" state that Galileo was conceived and planned by the European Commission as a typical civil infrastructure

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[13] There are 38 ESA History Studies Reports which are catalogued at http://www.esa.int/esapub/pi/hsrPI.htm

[14] J. Krige and A. Russo, *The Story of ESRO and ELDO, 1958 – 1973*, vol. 1 of *A History of the European Space Agency, 1958-1987* (AG Noordwijk: ESA Publications Division, 2000), xvi. http://www.esa.int/esapub/sp/sp1235/sp1235v2web.pdf (accessed February 14, 2008).

[15] "Galileo General Information Presentation," March 15, 2001. http://ec.europa.eu/comm/space/doc_pdf/galileo_presentation.pdf. (accessed November 7, 2007).

[16] ESA, "Why Europe needs Galileo," July 18, 2007. http://www.esa.int/esaNA/GGG0H750NDC_galileo_0.html. (accessed November 7, 2007)

program.[17] In 2002 Scott Beidleman in "GPS vs Galileo: Balancing for Position in Space" identified three main motivations driving Galileo: Improved performance, independence from the United States, and economic opportunity.[18] Sorin Lungu in "Power, Techno-Economics, and Transatlantic Relations in 1987-1999" argued that strategic independence and the fear of reduced influence in international affairs caused European leaders to select Galileo in the 1990s as a key economic tool to asymmetrically balance against American hegemony.[19] In 2001, Johan Lembke in *The Politics of Galileo* considered the national level and noted that Germany, the United Kingdom, and the Netherlands supported Galileo for commercial reasons more so than for strategic and political purposes. In contrast, France, Italy, Spain and other smaller countries downplayed the Galileo profit motive and stressed that strategic issues were driving Galileo.[20] Kazuto Suzuki in *Policy Logics and Institutions of European Space Collaboration* mentioned in passing that one of the original objectives of the Galileo program was for it to be used as a bargaining chip for pressuring the United States to remove Selective Availability (SA) from the GPS signal.[21] Suzuki notes that this objective was achieved in 2000 when the United States removed SA, negating a major rationale for the Galileo program. According to Suzuki this caused a "big headache" for European governments because the Galileo program had taken on a life of its own in the

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[17] L. Cucit and others, "Management and Organizational Models of the European Space Agencies: the Results of an Empirical Study," *Technovation* 24, (2004): 3.

[18] Scott Beidleman, "GPS vs Galileo: Balancing for Position in Space," *Astropolitics*, 3, Issue 2 (2005): 127.

[19] Sorin Lungu, "Power, Techno-Economics, and Transatlantic Relations in 1987-1999" [paper presented at the European Union Studies Association Biennual Conference 2005 (9th), Austin, TX, March 31 – April 2, 2005], 36. http://aei.pitt.edu/2996/ (accessed October 20, 2007).

[20] Johan Lembke, *The Politics of Galileo,* European Policy Paper no. 7, (Pittsburg: University of Pittsburg, University Center for International Studies, April 2001), 11. http://www.ucis.pitt.edu/euce/pub/policypapers/2001-Politics_of_Galileo.pdf (accessed Aug 20, 2007).

[21] Kazuto Suzuki, *Policy Logics and Institutions of European Space Collaboration* (Hants: Ashgate, 2003), 193. See Chapter Two for an explanation of Selective Availability.

ESA and EU Councils, apparently making it difficult for the Member States to terminate it.[22] Nonetheless, Suzuki concludes that commerce and autonomy were the primary incentives for Galileo. Joan Johnson-Freese in *Space as a Strategic Asset* argues that dependence on GPS is contrary to the interests of countries for which keeping up with globalization is a strategic goal. She also notes that potential economic returns in combination with concerns about dependence on the United States were powerful incentives for Galileo.[23] In addition, she calls Galileo an example of international cooperation to counterbalance the "American aerospace advantage."[24] It is not clear if she is referring to an American military, civil, industrial, technological or marketplace "aerospace advantage," or to all the above. David Braunschvig wrote in *Foreign Affairs* that that "several European governments agreed that an autonomous satellite navigation capability must serve as the basis for Europe's security and defense policy."[25] While all of these observers make sound arguments about what was driving Galileo, in general they consider the various drivers equally, don't make an effort to weigh their relative importance, and don't look into which level of analysis was most significant. Equally important, their observations on what is driving Galileo lack a foundation and supporting evidence based upon international relations theory. The fact that there has been

[22] Suzuki does not explore the implications of ESA and the EU having such a large measure of independence versus their Member States, however, and does not explore this alleged "stickiness" of the Galileo program and what this may say about whom and what was driving it. Nevertheless, Galileo may provide a potentially useful case study for future researchers to evaluate John Ikenberry's argument that international institutions do not simply serve the interests of states. They can become "sticky," meaning they can lock states into ongoing and predictable courses of action. G. John Ikenberry, "Institutions, Strategic Restraint, and the Persistence of American Postwar Order," *International Security* 23, no. 2 (Winter 1998-1999): 45. For more on the influence IO's have on states, see for example Robert O. Keohane and Lisa L. Martin, "The Promise of International Institutionalist Theory," *International Security* 20, no. 1 (Summer 1995), 39-52.
[23] Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), 14.
[24] Ibid.
[25] David Braunschvig, Richard Garwin, Jeremy Marwell, "Space Diplomacy." *Foreign Affairs* 82, no. 4 (July/August 2003): 159.

confusion and controversy about the rationale for Galileo suggests a major purpose of this study: to contribute to understanding on why the EU has the Galileo program in the first place and on why it will survive or fail in the future.

4. Summary of Methodology

How Galileo has been able to survive in the face of serious obstacles is the fundamental puzzle that this study addresses. This study proposes that the Galileo program has survived because of subtle changes of emphasis among the motives driving it. In order to detect those changes this study closely investigates European decision-makers' assessments of the need for Galileo at four key decision points: 1) The 1999 EU decision to pursue an independent navigation satellite capability and the approval of the "Definition Phase" of Galileo; 2) The March 2002 EU decision to continue to back Galileo and the approval of the Galileo "Development Phase"; 3) The June 2004 agreement between the European Union and the United States to make Galileo and GPS compatible and interoperable; and 4) The 2007 EU decision to fund Galileo's "Deployment Phase" entirely from EU public funds. In order to gain insight into the comparative weight of the various factors influencing European decision-makers over a range of time, the following three hypotheses will be tested at each of these decision points**.** **Hypothesis One:** Realist factors weighed the most heavily on European decision-makers' assessments of the need for Galileo. **Hypothesis Two:** Liberal factors weighed the most heavily on European decision-makers' assessments of the need for Galileo. **Hypothesis Three:** Ideational factors weighed the most heavily on European decision-makers' assessments of the need for Galileo. To test these hypotheses,

indicators of the presence of these factors are identified and subjectively weighed. In addition, the relative influence of the international, European, national, and industrial level will be considered. The national level includes an examination of French, German, Italian, and the United Kingdom perspectives on Galileo. In this way, the configuration of interests and how that configuration has changed over time will come to light and provide us a better understanding of why Galileo has survived. Chapter Three provides a detail description of the indicators of the presence of realist, liberal and ideational factors.

The time frame of this study runs from the 1960s to December 2007 and goes into a much greater level of detail from the mid-1990s. The technical aspects of satellite navigation and the Galileo system are not discussed in detail. Since the scope of this study is broad, with Galileo involving many actors and with many key decisions over the last ten years, I use selective judgment to limit the scope of the study to only the most relevant actors, such as the leading states in Europe with an interest in space, the most relevant decision-makers, and the key decision points.

Major primary sources include EU, ESA, and key Member State public expressions of policy such as policy statements, communications, resolutions, press releases, speeches, white papers, and other official reports and studies. Interviews with officials from ESA, the EC, CNES, the French military, and the European Defense Agency (EDA) were conducted, along with interviews of industry representatives and European scholars who influenced European space policy. Secondary sources include books, journals, monographs, magazine, and newspaper articles, especially articles from such periodicals as *Space Policy, Space News, Aviation Week and Space Technology,* and *GPS World.* One major problem in approaching this research topic is a lack of research

material which addresses the motivations for Galileo, and European space activities in general, from a political science perspective. Other problems relating to the availability of information include: the physical location of the action being in Europe, while the research is being conducted in the United States, which makes access to records and decision-makers problematic; the author's inability to assess French, German or Italian language documentation; potential obfuscation of motives; and possible security classification of valuable information. Thus, while a detailed examination of the various actors' motivations is the goal of this study, it may not always have been possible at the level of detail desired. In these cases we will have to be satisfied with understanding the major factors driving European decision-makers' assessments of the need for Galileo and how they have changed over the years.

5. Summary of Conclusions

As detailed in the chapters below, Galileo's ability to survive can be attributed to subtle shifts in European decision-makers' assessments of the need for Galileo. We find that the most significant drivers at the 1999 decision point were liberal factors at the international level. The June 1994 European Civil Aviation Conference in Copenhagen brought together EUROCONTROL, (the European organization for the safety of air navigation), ESA, and the EC Directorate General for Transportation and Energy (DG TREN) and delivered a political mandate for this "European Tripartite Group" (ETG) to begin formal cooperation in the development of a civilian controlled, global satellite navigation system. DG TREN led the ETG in the consultations that followed.[26] The EC

[26] Lembke, *The Politics of Galileo*, 6.

emphasized that this satellite navigation project needed to be coordinated at the EU-level in order to construct, integrate, and rationalize trans-European transportation and communications infrastructures. The view that efficient, integrated transportation systems are a tool to generate and meet demand for deeper European economic integration was the primary motivation, although its broader economic, social, and security significance were also well understood.[27] In addition, legitimate technical concerns, legal liability concerns, economic concerns, and political concerns about GPS and the fact that GPS was military-controlled contributed to the decision.

The most significant drivers at the second decision point in March 2002 are harder to discern. Nevertheless, it is reasonable to assert that realist factors at the international level were the most important motivators for Europe to press ahead with Galileo in spite of serious objections from the United States and unresolved funding and distribution of gains questions at the national level. Between 1999 and 2002, the EU took a number of steps which make it more valid to consider the EU analytically "as if" it were a state actor in the international arena. The development of the European Security and Defense Policy (ESDP) along with the development of a European Rapid Reaction Force, the Lisbon Strategy to make the EU the most competitive knowledge-based information economy in the world, and the economic integration of Europe with the euro are some of the factors which indicate that European decision-makers were beginning to see the EU as responsible for independently protecting its self-interest in the anarchic global environment. The terrorist attacks on the United States on September 11, 2001 and European discomfort with the unilateralist Bush administration also contributed to

[27] Ibid.

European decision-makers' desire to develop independent PNT capabilities in order to bolster Europe's political autonomy, security, and economic competitiveness.

The most important motivation at the third decision point under study, the June 2004 U.S. - EU agreement on GPS and Galileo interoperability and compatibility, were liberal factors at the international level. European and U.S. decision-makers decided international cooperation, leading to better efficiency, was the best strategy. The international agreement to make Galileo and GPS compatible and interoperable means that future PNT receivers will be capable of using signals from both types of satellites, which will significantly increase their accuracy and reliability. These two completely separate navigation satellite constellations provide redundancy for one another in case one of the systems becomes degraded or inoperable, for whatever reason. In addition, the United States agreed to share its expertise in the technology that makes precise satellite navigation signals possible, and the EU agreed to change one of the frequencies Galileo was planning to broadcast its signal on which had conflicted with U.S. future designs for the next generation of GPS satellites.

The 2007 EU decision to fund Galileo's "Deployment Phase" entirely from EU public funds is another story altogether. A confluence of ideational, liberal, and realist factors at the European and institutional levels was able to overcome especially stiff challenges from the national and industrial levels, while the market justifications for Galileo steadily eroded. China and India's rapidly improving space capabilities made Europe's ability to follow through on Galileo a matter of European pride and prestige at the international level and within Europe. The credibility of the EU as an institution able to efficiently meet the collective needs of its member states was also at stake. Growing

insecurity in the world, as a weakened United States became bogged down in Iraq, NATO lost ground in Afghanistan, Russia demonstrated the ability to squeeze European energy supplies, and the Chinese successfully tested an anti-satellite weapon, insured that European decision-makers' assessments of the need for Galileo were heavily influenced by realist factors. Indicators that realist factors were exerting strong influence in European decision-makers' assessment of the global environment include the EU adoption of the "European Security Strategy (ESS) in 2003, the founding of the European Defense Agency (EDA) in 2004, the announcement that two 60,000 strong EU Battle Groups had become fully operational in January 2007, the activation of the EU Operations Center in June 2007, and the conduct of ten EU operations outside of Europe ranging from purely military missions, to policing, to security institution building, and involving roughly 10,000 EU personnel in 2006 alone. In short, the ESDP was considered the most dynamic area of EU development and the relevance of Galileo to European security could not be downplayed anymore.

6. Overview of the Study

This dissertation is divided into two parts and eight chapters. Part one includes the first three chapters and provides an overview of the study, describes the European space sector, states key definitions, and explains the study's methodology. Chapter One provides an introduction and an overview of the study. The second chapter includes descriptions of key European actors at the various levels, useful definitions, and a short overview of GPS and Galileo terminology. Chapter Three provides a detailed look at methodology including a brief overview of the realist, liberal and ideational perspectives;

specific realist, liberal, and ideational factors being considered, and indicators of their presence.

Part Two includes the chapters which describe the evolution of a variety of significant trends (described below) which converged at each decision point. Chapter Four is a chronological study of the growing importance of satellite navigation through 1999 and the EU decision to pursue an independent navigation satellite capability and fund the “Definition Phase” of Galileo. Chapter Four is the most lengthy in the dissertation because it also describes the evolution of many key trends which converged with the growing importance of satellite navigation in 1999 including: the evolution of the EU’s interest in space and security issues; the rise of the commercial space sector; the consolidation of the aerospace industry; the growing popularity of Public Private Partnerships; ESA’s problems in the 1990s; and the background of the space programs in France, Germany, Italy, and the United Kingdom

The chapter concludes, as each of the case study chapters conclude, with an analysis which seeks to deduce which of the three hypotheses is most likely not to be rejected. In addition, a judgment is made about which level of analysis was the most influential.

Chapter Five picks up where Chapter Four left off and chronologically traces events up to the March 2002 EU decision to continue to back Galileo and the approval of the Galileo “Development Phase.” Chapter Six continues the chronology but focuses exclusively upon the June 2004 agreement between the European Union and the United States to make Galileo and GPS compatible and interoperable. Chapter Seven picks up the remaining threads from the March 2002 decision and brings the chronology up to the

2007 EU decision to fund Galileo's "Deployment Phase" entirely from EU public funds. Chapter Eight, the final chapter, summarizes the results of chapters four through seven, analyzes the shifting mix of motives that have kept Galileo alive, discusses the significance of the international, European, national, and industrial levels, and makes predictions about the future course of Galileo. It also appraises the usefulness of the method used in this study.

Laying the foundation for this investigation begins with a description of the European space sector, useful terminology, and some GPS and Galileo basics.

Chapter Two:
The European Space Sector, Terminology, and GPS and Galileo Basics

This study does not require that we trace every aspect of the EU, or ESA, or their Member States' space programs. However, this study does require that we have a basic understanding of the structure of the European space sector, as well as an appreciation of the context within which it operates. The first section below provides this understanding by introducing the main actors in the European space sector and describing important aspects of the European space sector's evolution from the mid-1990s to 2007. Section two introduces terms and frameworks commonly used in the analysis of space policy, and which are integrated in the analysis to follow. The third section presents a high-level overview of GPS and Galileo with brief descriptions of some of their relevant technical and organizational details. It may not be necessary for readers already familiar with these topics to review this chapter, although they may find it useful. Nevertheless, the building blocks outlined below provide the foundation upon which this study launches into the detailed examination of the Galileo program.

1. The European Space Sector:

This section describes today's European space sector's main actors and their organizational structures, financing, priorities, and interactions, and how they have evolved since the mid-1990s. This background information provides some of the broad context in which the Galileo program developed, thereby shedding light on how and why decisions about Galileo were made. The best place to start is with the arrangement of the European space sector into three levels.

The three levels of space activity in Europe are the European-level, the Intergovernmental Organization (IGO)-level, and the National level.[1] The primary actors in these levels are respectively, the EU, the European Space Agency (ESA), and the major space faring states of France, Germany, and Italy. Other European states such as the United Kingdom, Spain, and Belgium are actively involved in space activities, but at a level of investment and involvement below France, Germany and Italy. Across these levels, Europeans combined spend about 6 billion euros per year on space activities.[2]

The European-level: This study defines the European-level of space-activity as those activities approved and directed by the EU in order to meet EU policy objectives and which receive significant funding from the EU budget. The European-level is the newest level, really only arriving on the scene in a significant way with the initiation of the Galileo program in 1999. Galileo's place in the EU in general, and in the EC in particular, is important for the analysis to follow.

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[1] We must be careful not to confuse these levels of space activity in Europe with the international, European, and national levels of analysis used in this study.
[2] ESA, "European Space Industry in a Global Context." http://ec.europa.eu/enterprise/space/doc_pdf/fact_and_figures_en.pdf (accessed August 15, 2007).

- **European-level:**
  - European Commission (Pillar One):
    - Transport and Energy DG – Galileo.
    - Enterprise and Industry DG – GMES and Space Policy Unit.
    - Research DG - GMES and Space Policy Unit (until 2004). Still provides significant funding to GMES and Galileo.
  - CFSP (Pillar Two)
    - European-level and national level military space capability requirements tracked for use in EU military and security operations. Control of national level military capabilities is retained by contributing nations.
- **Intergovernmental-level:**
  - European Space Agency.
  - European Organization for the Exploitation of Meteorological Satellites (EUMETSAT).
- **National level:**
  - France, Germany, Italy, United Kingdom, Spain, Belgium, others.

Figure 1. European Space Sector Levels

The EU has three organizational "pillars." The first and second pillars are organizationally very different, yet both have space requirements and participate in space activities. The EU first pillar is managed by the European Commission (EC) which deals with political and economic issues and policies. It is considered a *supranational* entity. Galileo and the Global Monitoring for the Environment and Security (GMES) earth observation satellite program are being developed, managed, and funded within Pillar One. Pillar One, however, includes 27 Directorates-General. Each Directorate-General is powerful unto itself and possesses a large degree of autonomy. The Galileo program got its start in the 1990s, as discussed in detail later, under the Directorate-General for Transport, and remained there in 2007. Galileo receives the EC portion of its funding from the Directorate-General for Transport budget line, and as of 2007, in a very controversial decision, from excess EU Common Agricultural Funds. In contrast, the

GMES space program, and the EC's Space Policy Unit, resided within the Directorate-General for Research until 2004. Then they were moved to the Directorate-General for Enterprise and Industry, which is higher in the EC hierarchy. The shift to the Directorate-General for Enterprise and Industry in 2004 was meant to raise the organizational status of space in the EC and emphasize that space issues go beyond research and instead cut across many EC policy areas that are integral to making Europe the world's leading information-based economy, are strategic economic and industrial issues, and are linked to security.[3] Hence, the two main space projects within the EC, Galileo and GMES, are in very different, nearly autonomous organizations. Likewise, the Space Policy Unit, with the people responsible for thinking about the role of space in the EU, is organizationally split from Galileo. Harmonizing the EC's fragmented space goals, requirements, and interests among these semi-independent Directorate Generals has been a constraint on the EC's ability to be a significant actor in the European space sector. However, the situation may improve due to the July 2007 draft Reform Treaty which designates "space" as a shared competency between the EU and Member States. When (and if) ratified, this will place space activities, including Galileo, at a much higher political and institutional level within the European Union and possibly reduce some of the bureaucratic barriers hindering Galileo's development within the EC.

Pillar One is also inhibited from acting in the defense and "security" realms. The EC (and its predecessor organization the European Economic Community) is traditionally confined by the Member States to issues of an economic and political nature. After the Cold War, the definition of security began to loosen, however, and "security" in the first

[3] John Logsdon, "*Europe and Space a Status Report*," (speech given at International Space University, Strasburg, December 2005).

pillar gradually came to defined as “economic security” or “human security” or “environmental security” and eventually even along the lines of the U.S. concept of “homeland security” relating to management of problems caused by natural disasters, humanitarian crises, terrorism, organized crime, and border security (Chapter Three discusses the various definitions in detail). However, the culture to deal with security issues in the EC, even within the broadened definition of security above, has only slowly evolved since the 1990’s. For many years it was sensitive politically and organizationally to talk within the first pillar about the security nature of the civil Galileo and GMES satellite systems. In 2004, for example, the EC Head of Unit, Preparatory Action for Security, described the security dimension of the Galileo program as a “hot potato.”[4] So until quite recently, rigid organizational requisites made the Galileo program officially keep to a strictly civil nature.

However, demonstrating that times have changed, the security dimension (including the military security dimension) of Galileo is now acknowledged and the 2007 European Space Policy specifically points out that Galileo “may have military users.”[5]

The second pillar is considered an *intergovernmental* organization and is closely controlled by Member States through the very powerful Council of the European Union, previously called the Council of Ministers. The Council of the European Union is the main decision-making body of the European Union. It consists of one minister from each of the 27 Member States. Depending on the topic, each EU Member State is represented by its minister responsible for that subject. For example, Transportation Ministers from

[4] Herbert von Bose, EC Head of Unit, Preparatory Action for Security, interviewed by author, Brussels, Belgium, June 14, 2004.
[5] Commission of the European Communities. *Communication from the Commission to the Council and the European Parliament*: *European Space Policy*, COM (2007) 212 (Brussels: EC, April 26, 2007), Section 3.4.

each Member State meet to decide issues regarding European transportation infrastructure. Since Galileo was conceived, approved, and funded as a part of European transportation infrastructure, Galileo issues are decided by the Transportation Ministers from each member state, who also deal with issues concerning European air traffic management, rail, port, and highway issues. On the other hand, GMES issues are decided upon by a different set of ministers from the Member States, since GMES is considered an environmental project. And the fragmentation goes on. The Council of the European Union consists of the Defense Minister from each Member State when issues related to defense and security are discussed. The result is that inefficient decisions may occur or progress may be brought to a crawl when issues cut across various sectors, such as the security and defense issues that arise from the dual-use nature of Galileo and GMES. These issues then must rise up to the level of the European Council, the summit, which is composed of the Member States' heads of state and government, and which meets every six months.

The EU second pillar is solely responsible for military security issues with the word "security" in Pillar Two having more traditional defense and military connotations. Pillar Two is where the Common Foreign and Security Policy (CFSP) and the European Security and Defense Policy (ESDP) are managed, allowing EU security and defense issues to be tightly controlled by the Member States. Consequently, space activities in Pillar Two, such as they are, focus on supporting the needs of CFSP and ESDP, or in other words, enabling the EU's military power. Normally, individual Member States actually provide the required space capabilities, such as telecommunications, needed for EU military activities, but this is evolving. For example, the EU Satellite Center (EUSC),

which purchases satellite imagery from commercial providers and interprets the data for the EU High Representative for the Common Foreign and Security Policy, and the other staff atop Pillar Two, has been a dedicated Pillar Two resource since 2002.[6] Pillar Two may have uses for future Galileo dual-use PNT capabilities in the operation of EU Battle Groups and other ESDP security operations, but such requirements are normally outside the organizational purview of the EC Transportation Directorate General in Pillar One. However, this does not mean that opportunities for consultation and coordination between Pillar Two and the Galileo project do not exist.

Since the early 1990's, the EU has established various bodies to coordinate space efforts between Pillar One and Pillar Two, across the Directorates General in Pillar One, between the EU and the Member States, and between the EC and ESA including: the Space Advisory Group (1992); the Space Coordination Group (1992); the Space Policy Unit (1999); the Joint Space Strategy Advisory Group (2000); the Joint Task Force (2000); the EC/ESA High-level Space Policy Group (2004); the EC/ESA Framework Agreement Secretariat (2004); the European Space Council (2004); and the Panel of Experts on Space and Security (2004). The roles, evolution, and significance of these bodies are outlined, as necessary, in the course of the Galileo case study below.

The means for funding European-level space activities has also evolved since the initiation of the Galileo program. As detailed in the chapters below, Galileo was the first major space activity to receive a significant portion of its funding from the EC budget, specifically the Trans European Networks (TENs) budget. However, today, there are more funding streams available at the European-level to finance space activities. In Pillar

[6] The EUSC was the Western European Union (WEU) Satellite Center until it was incorporated as an agency into the EU on 1 January 2002 with the role of supporting the ESDP.

One they include a virtual budget line for space in the 2007-2013 EU *Financial Perspective* (FP7), a dedicated space research budget in the EU *7th Framework Program for Research* (2007-2013), funds from the *European Security Research Program* (2007), EU Structural Funds, basic infrastructure budgets and in the recent past, the 2004-2006 *Preparatory Action on Security Research*. Pillar Two funding streams include contributions made by member states toward common costs based on their individual Gross Domestic Product (GDP) and spending from the new European Defense Agency (EDA) in support of the ESDP and CFSP. Increased expenditures, designation of new sources of money, restructured processes, and new efficiencies to free up more money for space have changed the context at the European-level in which the Galileo program exists. Overall, however, the amount of money dedicated at the European-level remained relatively low until the 2007 Galileo funding crisis forced the EU to dramatically increase its funding for Galileo.

Although controversial, the funds to keep Galileo alive in 2007 were found by redirecting agricultural funds within the current Financial Perspective (FP7). This move was approved by the European Council.

The EU's Financial Perspective provides a framework for the EC's budget priorities over a period of several years. For example, FP7 runs from 2007-2013. A Financial Perspective is arrived at only after several years of hard bargaining among the Member States. A Financial Perspective allocates each EC Directorate General a portion of the budget. The Transportation Directorate General uses part of its budget to fund its share of the Galileo program. Once a Financial Perspective is agreed upon, it is changed only in extreme circumstances, since "re-opening" the Financial Perspective means all

Member States must start the bargaining process over again. Not even the 2007 Galileo funding crisis was considered extreme enough to reopen FP7. However, this did not mean there was no flexibility in how the EC used the funds within FP7. In the end, a way was found to keep Galileo alive.

The primary tool for financing EC space activities other than Galileo is the EC research budget. Part of the Financial Perspective includes the EU *Framework Program for Research*. The EU *7th Framework Program for Research* runs from 2007 to 2013 and allocates a dedicated amount of money specifically for space research and security research. This is the first time a EU *Framework Program for Research* has dedicated money for security or space research. Four billion euros is evenly split between the space research column and the security research column. Interestingly, the proposal calls for security research to be focused specifically on the topics of space and security.

This brief overview of the European-level of space activity provides us some important context that helps us better understand some of the obstacles which Galileo has faced and which help us better explain the Galileo program's ability to survive. Next, a brief description of the so-called "intergovernmental-level" of the European space sector supplements this knowledge in important ways.

The Intergovernmental-Level: The European Space Agency is the primary actor at the Intergovernmental Organization (IGO) level and the only actor at the IGO-level which will be examined for this study.[7] ESA is not part of the EU; it has a separate charter and different membership. This was the top level of the European space sector before Galileo

[7]The European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) is another very successful European intergovernmental space organization, responsible for Europe's meteorological space activities.

and it still dominates European space activities with the size of its budget and the number and magnitude of its programs. In order to understand the context in which the Galileo program has existed, it is important to understand how ESA has changed since 2000.

ESA is an intergovernmental research and development organization which does not have the legal competence, even at the ESA Council at Ministerial-level (described below), to make decisions regarding operational follow-ons to its programs.[8] Therefore, ESA is not considered strong politically at the European-level or at the national level. The highest political level it operates at is when each ESA Member State's Ministers of Research (or equivalent) get together for a meeting about once every three years. Strong and consistent political support is therefore lacking. Nevertheless, ESA provides its Member States sophisticated capabilities in space launch, space science, exploration, research, technology, program management, acquisition, and competence in the implementation of complex space projects.

ESA is headquartered in Paris and has 17 Member States: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. In contrast, the European Union has 27 Member States. Norway and Switzerland are members of ESA, but they are not members of the EU. On the other hand, EU Member States from Central and Eastern European are not members of ESA and some in ESA are concerned that further expansion of ESA membership, each with one vote, will dilute the

[8] Xavier Pasco and Laurence Jourdain, "Comparative Space Policy: The Space Policy Crisis in American, European, and French Space Programs" in *Space Policy and Politics*, ed. Eligar Sadeh, (Dordrecht, The Netherlands: Kluwer Academic Publishers, 2002), 328.

power of the traditional members of ESA.[9] The Galileo project faces this layer of organizational barriers since the EU and ESA work together on Galileo, as described in Chapter Four. The combination of the EU and ESA in the Galileo program means that 29 states have input into the Galileo program.

ESA is governed by the ESA Council. The ESA Council writes the *European Space Plan,* approves current and future programs, and makes long-term funding decisions. Each Member State gets one vote on the Council. Member States are usually represented on the Council by a delegate from the Member State's ministry responsible for space activities. This is usually a Research or Technology Ministry. In contrast, Transportation Ministers from EC Member States represent their state's interests regarding Galileo at meetings of the Council of the European Union, as noted above. In sum, Galileo issues usually belong to Member States' Transport Ministers in the EU, while Galileo issues belong to Member State's Research and Technology Ministers in ESA. Naturally, this represents another bureaucratic barrier to the smooth development of Galileo.

The ESA Director-General (DG) is elected by the ESA Council every four years and is institutionally powerful. Antonio Rodotà was the DG from 1997 until 2003. Jean-Jacque Dordain became the DG in July 2003 and was reappointed in 2007.[10] The official Galileo program, therefore, has spanned the tenure of only two ESA DG's.

As an IGO, ESA is primarily concerned with serving its customers, the Member States. The mission of ESA is to execute programs approved and funded by Member States. This "mission" helped form ESA's organizational structure, its culture, and its

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[9] Chris De Cooker, ESA head of External Affairs, interviewed by author, Paris, France, September 17, 2007.
[10] Thanks to Dr John Logsdon for providing me information on this point.

funding. Its measure of success is “programs.” The more programs the ESA Member States are asking it to do, the more successful ESA is accomplishing its mission.[11]

ESA’s programs and funding are divided into two categories. The first program category is Mandatory Programs. All Member States are required to contribute funds to Mandatory Programs. Contributions are based on the Member State’s Gross National Product (GNP) and are used to fund space science programs, the Technology Research Program, administration, common services, and other overhead. Since contributions are based on GNP, this means that Germany, France, Italy and the United Kingdom are the biggest contributors. Naturally, since Germany contributes a lot, it wants a big say and a significant return on the investment. But it has only one vote, like every other Member State. This sometimes creates a sense of frustration for Germany.[12]

The second program category is Optional Programs. Here Member States decide which programs to participate in and how much money to contribute. The foundation of ESA funding rests upon the principle of *juste retour*.[13] That is, the amount invested by ESA within a member country, for a specific program, is based upon how much that country contributed to the relevant project. Contracts are awarded accordingly. However, the 2003 EU/ESA *Framework Agreement* which formalized the relationship between the EC and ESA established that the EC can now participate in ESA Optional Programs, but with one huge difference setting it apart from how a regular Member State participates. ESA cannot be bound to the ESA funding rule of *juste retour* with regard to

[11]Frederick Nordlund, Head of ESA Washington D.C. office, interviewed by author, Paris, France, June 11 2004.
[12]Ralf Huber and Volker Liebig, interviewed by author, Colorado Springs, Colorado, March 30, 2004.
[13]Also referred to as geographic return, geographic distribution, industrial return, or fair return.

the money it receives from the EC. Many Galileo funding issues revolve around how this difference in funding mechanisms is applied.

For nearly two decades, ESA operated very successfully within the organizational and fiscal paradigm outlined above, but beginning in the 1990s, ESA faced intense pressure to change. In 2003, with the growing influence of the EC in the European space sector, ESA's members decided that ESA must adapt to survive and remain relevant. The 2003 EC *White Paper*, the 2003 EU/ESA *Framework Agreement*, and especially ESA's *Agenda 2007* (written by Dordain) are the documents that guided change at ESA starting in 2003. With these as the foundation, Dordain instituted many reforms to restructure and align ESA with the EC-led European-level, and to prepare for ESA's future role as Europe's space agency.[14]

In brief, Dordain implemented a re-interpretation of the ESA charter, conducted internal re-organization, designed new financial structures, and established new external interfaces.

For ESA to fulfill its role under the EU/ESA *Framework Agreement* which came into effect in May 2004, and for it to fulfill its future role as Europe's space agency, ESA redefined what "peaceful purposes" means in its charter. The *ESA Convention*, Article II, states:

> *The purpose of the Agency shall be to provide for and to promote, for <u>exclusively peaceful purposes</u>, cooperation among European States in space research and technology and their space applications, with a view to their being used for scientific purposes and for operational space applications systems…*[15]

[14] Geraldine Naja, Head of the Institutional Matters and Strategic Studies Office, ESA Director General's Policy Office, interviewed by author, Paris, France, September 17, 2007. Geraldine Naja stated that it makes sense for ESA to become the EU's space agency and that it will happen.

[15] ESA Publications, *Convention for the establishment of a European Space Agency and ESA Council*, (Noordwijk, The Netherlands: ESA Publications Division, March 2003), 10.

Until December 2003, ESA only participated in scientific and commercial programs that adhered to a definition of peaceful purposes to mean no security or defense applications. Since then, ESA has interpreted "peaceful purposes" to mean "non-aggressive."[16] This allows the use of space assets for security related surveillance, communication, earth observation, meteorology, and navigation, timing and positioning. In fact, ESA decided the reference to "peaceful purposes" does not restrict ESA from engaging in multi-use activities or activities of a military nature. This was a significant change at ESA. It is said that previous to 2003, the words "defense" and "ESA" had never been used anywhere near each other. Nevertheless, it brings the ESA interpretation of "peaceful purposes" in line with the U.S., Russian, and other states' interpretation of the *Outer Space Treaty* limitation on the use of space only for "peaceful purposes."[17]

Through *Agenda 2007*, Dordain directed many organizational changes. Before April 1, 2004 ESA had nine Directorates designated functionally as follows: Science, Launchers, Earth Observation, Human Spaceflight, Application Programs, Industrial Matters and Technology, Technical and Operational Support, Strategy and External Relations, and Administration. After April 1, 2004, the Directorate of EU and Industrial Programs (renamed the Directorate of Telecommunication and Navigation in October 2006) was formed. This Directorate is responsible for management of ESA participation in the Galileo program and reflected the importance of the new relationship with the EU.

[16]European Space Agency Council, "Position Paper on ESA and the Defense Sector," ESA/C (2003) 153. (Paris, December 1, 2003), 7-8. This is an unpublished, not publicly released document.
[17]Ibid.

In addition, Dordain consolidated policy, planning, and strategy at the DG's in order to insure the entire organization was unified and moving in one direction.[18]

The coming into force of the EU/ESA *Framework Agreement* in May 2004 also drove another important organizational change. It had been agreed that the EU provides the "demand" for space applications, and ESA provides the "supply." However, since the ESA is not yet part of the EU, it has not been formally subject to EU policy decisions and management. This disconnect may also have inhibited the smooth development of the Galileo program.

Nevertheless, the *Framework Agreement* placed an ESA office in Brussels and physically demonstrated the changed dynamic and the positioning of ESA closer to the EU. The head of the ESA Brussels office has special authority to act on behalf of the ESA DG and is referred to as an ESA "Executive at Director-General level."[19]

The Galileo program's security requirements created the initial prompt for ESA to begin dealing with issues involving information security, physical security, and personnel security. Later, ESA security processes were put in place in order to position ESA for its role in the *Framework Agreement* and as the future EU Space Agency. ESA members realized that no cooperation could take place with the defense sector without an ESA security plan.[20] The ESA Security Committee was set up in June 2002 to advise the DG on security and prepare industrial security rules. A *Security Agreement* and the first ever *ESA Security Regulations* came into force in June 2003, enabling ESA to handle and exchange classified information with Member States.[21] It established a classification

[18]Frederick Nordlund, interviewed by author, Paris, France, June 11, 2004.
[19]Dick Shirvanian, ed. *2004 European Space Directory*, (Paris: Sevig Press, 2004), 7.
[20] European Space Agency Council, "Position Paper on ESA and the Defense Sector," 11.
[21] Ibid

system, e.g. "ESA Secret," and shifted the handling of classified information from Member States to ESA. Likewise, people involved in classified areas of Galileo were granted national security clearances. The ESA Security Office was established and tasked to set up a comprehensive security system. It reports directly to the Director General. The security system is compatible with Member State security standards and meets the security requirements necessary for involvement in the EU's CFSP and ESDP.

The tension between the United States and the EU over Galileo prior to the June 2004 agreement on Galileo and GPS is an example of how the context of the European space sector has changed and the previous focus on ESA – NASA cooperation as the totality of U.S. - European cooperation in space is insufficient. As the former Head of NASA in Europe put it when discussing Galileo, "NASA had no dog in that fight."[22] There is a tradition of close cooperation between ESA and NASA in many projects. Virtually all of those cooperative projects can be categorized as scientific and exploratory projects including heavy involvement in the International Space Station (ISS). This relationship is well documented and well understood and is not the focus of this study. ESA's *Agenda 2007* states: "NASA is the oldest partner of ESA and cooperation between the two is exemplary in the domain of Science." It goes on to identify Earth Sciences and the ISS as areas for future potential exemplary cooperation with NASA. However, it also states: "Other cooperations [sic] are foreseen with the United States, but this time the partner is *not* NASA but the DoD: Galileo and the GPS constitute a theme for cooperation that is under discussion." (Italics added). It identifies "guaranteed access to space" and "future space transportation systems" as well as mutual backup agreements for governmental launches, and development of reusable systems as future areas for DoD

[22] Don Miller, Head of NASA in Europe, interviewed by author, Paris, France, June 11, 2004.

- ESA cooperation.[23] The Galileo experience demonstrated the importance of this new relationship among the DoD, ESA and the EU. One can expect this relationship to grow in magnitude and importance as the EU increases its security space activity and ESA is tasked to do more in the security space and multi-use space realms.

This brief overview of the Intergovernmental-level of European space activity provides us some important context that helps us better understand some of the obstacles which Galileo has faced. The mismatch in membership of the EU and ESA, ESA funding mechanisms, ESA's lack of political authority and its interpretation of "peaceful purposes" in its charter and its reorganization since 2003 in order to position itself to be the EU's space agency are facets of ESA which help us characterize the context in which Galileo has existed. Next, a brief description of the national level of the European space sector supplements this knowledge in important ways.

The National Level: The third level of European space activities is the national level. The national level is where sovereign national space activities exist, paid for and managed by an individual nation. The national level is best understood by examining the three major state actors in the European space sector; France, Germany, and Italy. They invest the most and are the most active in space activities. The United Kingdom, Spain and Belgium also invest in space activities but only the United Kingdom is investigated in this study. For the most part the rest of the EU and ESA Member States have not exercised leadership or been proactive in the European space sector. Understanding the

[23] Bruce Battrick, ed., *Agenda 2007: A Document by the ESA Director General*, (Noordwijk, The Netherlands: ESA Publications Division, October 2003), 18.

organization and civil and military space activities of these national level actors provide important context for understanding the Galileo program.

The French Space Program:[24] France is the lead space-faring nation in Europe. It is the spearhead of European space activities and thinks the most strategically about space. It dominates ESA, even though not always the largest financial contributor, and is the driving force in developing European-level space policy and initiatives. France is the only European state with comprehensive space competencies including launch (formally an ESA capability), earth observation, meteorological, and telecommunications expertise, along with the necessary scientific, technological and industrial infrastructure. The amount France spends on space represents 40 per cent of European civil and military expenditures on space. France spends double the amount on space per capita than any other European state.[25] France contributes the most to ESA's budget and spends more than double the amount on military space than the rest of Europe combined.[26] The French made a six-year budget commitment to ESA in 2005 to invest 685 million euros per year through 2010.[27] As a 2003 strategy plan on French Space Policy put it, "without [France], there is no European space activity."[28]

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[24]Due to the limited number of English language resources much of the information in this section came from interviews with French officials in CNES, the French military, and other officials and observers of the European space sector.

[25]Serge Plattard, interviewed by author, Paris, France, June 11, 2004.

[26] Istituto Affari Internazionali, *International Report on Space and Security In Europe, Executive Summary* (Rome; Istituto Affari Internazionali, November 2003), 16. http://esamultimedia.esa.int/docs/SpaceSecurityExecutiveSummaryFinalIAI.doc. (accessed June 10, 2007).

[27] Peter B. de Selding, "Stable 2005 Budget Allows CNES to begin New Satellite Projects," *Space News,* 10 April 2006, 3.

[28] European Commission, *French Government Aims to redefine CNES' role in European space activities*, Press Release, January 29, 2003, http://www.spaceref.com/news/viewpr.html?pid=10548 (accessed July 23, 2004).

French space policy is proposed and implemented by the French Space Agency CNES. In 2006, the CNES budget was 1.377 billion euros with 691.6 million euros going toward French national programs and the rest going to ESA. Its objective is to meet civil and military needs of the French government. Even though CNES has mainly a "civil" image, it is not a purely civil space agency.[29] A formal military advisor sits close to the president of CNES and armament engineers and joint officers from the Armament Procurement Agency (DGA) participate in program management. The result is that CNES is sensitized to defense priorities and requirements and manages some security development programs.[30]

Another aspect of CNES to note is that it is a public corporation with an industrial and commercial charter that acts as prime contractor during all steps in the French space program. As such, CNES is a shareholder in eleven companies with holdings in space transport and Earth observation, among others.[31]

CNES is tasked by various customers to develop programs all the way through to the operational stage. Some of these customers may include the Ministry of Defense, France Telecom, the Directorate General for Civil Aviation, universities and many more. French participation in cooperative international space projects is also coordinated by CNES. Most of these projects are with ESA, the United States, Russia, and Japan.[32]

CNES was restructured in 2003 and 2004; this reorganization included the creation of a space-defense group to oversee CNES's military effort. The group includes representatives from the French Joint Military Staff, DGA, and of course CNES. Its

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[29] Istituto Affari Internazionali, *International Report on Space and Security In Europe*, 70.
[30] Serge Plattard, interviewed by author, Paris, France, June 2004.
[31] *Subsidiaries and holdings*. http://www.CNES.fr. (accessed June 15, 2007).
[32] *CNES: The Organization of Space Activities in France*, http://ceos.cnes.fr.8100/cdrom-00b2/ceos1/gb/lecnes.htm (accessed June 15, 2007).

purpose is to help CNES better anticipate French Ministry of Defense requirements, propose space-based solutions, increase transparency, and provide oversight of CNES spending of Defense Ministry funds.[33] In addition, the French Prime Minister's Office includes the position of "Galileo National Coordinator of the French Government," with the position most recently held by Patrick Bellourd.[34]

The French military views military space capabilities as a support function to the rest of the military.[35] Moreover, French military space has never taken priority over any other armament program.[36] Significantly, no specific branch of the French military has responsibility for military space and the defense budget has no dedicated line for space. It has never been a priority for any of the French armed forces. This is surprising because French space competence and the level of investment in space seem to indicate a more comprehensive military space policy with more strategic thought. But most French security space activities are for strategic intelligence, rather than for the military.

Since the French are the top space-faring power in Europe a question may be raised about why France would support the restructuring and integration of European space policy and programs within the EC. Doesn't France have the most to lose? Won't its space power be diluted by the European-level? France has taken a pragmatic approach to this issue. First, France simply can't afford to finance its own large scale space systems such as Galileo. France does not have the "critical mass" of funding available for robust, totally independent programs. The resources to meet the technological

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[33] Ibid.

[34] Peter B. de Selding, "Britain, France at Odds Over Military Use of Galileo Service," *Space News*, June 19, 2006. http://www.space.com/spacenews/archieve06/Military_061906.html (accessed February 11, 2008).

[35] Lt. Col. Christophe Morand, French military space official, interviewed by author, Paris, France, September 20, 2007.

[36] Istituto Affari Internazionali, *International Report on Space and Security In Europe*, 72.

challenges of such a large-scale endeavor are not available at the national level. This was the original rationale for ESA. France pressed hard for the creation of ESA because it could not fund the development of a launch vehicle themselves. Therefore, the French consider ESA success as the same as French success.[37]

So burden sharing is really the only option to implement programs of Galileo's size. But France and other key nations lost confidence in ESA in the 1990s (detailed in depth in Chapter Four). The economy of scale provided by the EU was an alternative means for France to benefit from such a system as Galileo and for French space activities to grow. France looses some control but still reaps major profits, gains the strategic capabilities Galileo provides, and still retains a leadership role. [38] European-level success in space will also be considered by France to be the same as French success. Thus the integration of the European space sector at the European-level is not a big change in approach for the French to make. French nationalists have never objected to these types of shared endeavors either.[39]

French industry is also positioned the best to benefit from an integrated approach to European space activities. It has the most space experience and competence in the European aerospace industry so increased emphasis and funding of space activities benefits French industry. Likewise, French industry has the most to gain from the relaxation of the ESA *juste retour* rule. The EC will give the contracts to the companies that can get the job done most efficiently instead of distributing contracts across ESA Member States based on those states' contributions to ESA. French industry, with its

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[37]Jean-Pascal Le-Franc, interviewed by author, Paris, France, June 11, 2004.
[38] Lungu, "Power, Techno-Economics, and Transatlantic Relations."
[39] Serge Plattard, interviewed by author, Paris, France, June 11, 2004.

size, competence and experience in space activities, can be expected to land more high value contracts.

Finally, the 2007 EU *Reform Treaty* includes space as a "shared competency." It is "shared" in large part due to French advocacy for this position.[40] Shared means the EU can define and implement space activities, but national level programs retain autonomy. Member States can keep their own, separate space programs, separately funded, without interference from the EU. The French, therefore, retain full control of their own space activities at the national level, but get the benefit of the economy of scale the EU provides for programs the French could not afford themselves.

France is also working multi-laterally and bi-laterally to improve its security-related space capabilities. The "Common Operational Requirements for a European Global System of Observation by Satellite" (COR) initiative, also known as the "Besoins Operationels Communs" (BOC) initiative, begun by France, Germany, Italy, Spain, and Belgium for the development of future space reconnaissance systems, provides for sharing of the information provided by the space assets developed under this initiative. The EU will be allowed to use the data developed by this capability.

France is also taking part in a NATO satellite telecommunications project. France is participating in a consortium along with Italy and the United Kingdom to provide NATO with telecommunications capacity. France provides capacity from the new Syracuse 3 military satellite communications system. Italy contributes capacity from their Sirical 1 satellite, and the United Kingdom provides capacity from Skynet satellites.

France is cooperating with Italy on an Earth observation system which combines two civil, dual-use satellite constellations. The French contribution includes two high

[40]Serge Plattard, interviewed by author, Paris, France, June 11, 2004.

resolution Pleiades electro-optical satellites.[41] The Italian constellation includes four COSMOS-Skymed high-resolution radar satellites.[42] Since it is a civil program, the military will have to pay for the images it requests. The European Union Satellite Operations center will also benefit from the data Pleiades will provide. This is a good example of the leveraging of dual-use systems and how barriers between the civil and military sectors, and the national and European-level are eroding.

France also has a data sharing agreement with Germany. The Germans share data from their military "SAR-Lupe" constellation of radar satellites and in return France shares the optical data from the military Helios Earth observation constellation. Additionally, France and Germany signed a framework agreement in 2002. The purpose of the agreement is to develop cooperation and define a strategic blueprint for a strong European space industry.

The French are a driving force behind all levels of European space activities including Galileo. Understanding the organization, interests and space activities of France provides important context for understanding the Galileo program.

The German Space Program: Germany is the largest contributor to ESA mandatory programs, (due to its GNP) and contributes the second most money to ESA overall. It is so committed to ESA that nearly 80 percent of German funding for space activities goes to ESA, leaving only 20 percent of its budget for national level programs.[43] The total

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[41] "Government Procurement Report: International/ French Space Agency Has Numerous Satellite Projects in 2004," *Satellite News*, November 2003. http://www.telecomweb.com/samples/gpr110103.htm (accessed November 30 2007). Pleiades ground resolution is 70 cm across a 20 mile swath.
[42] John M. Logsdon, "A Security Space Capability for Europe? Implications for US Policy," *Space Policy* 18, (2002): 274.
[43] Volker Liebig, interviewed by author, Colorado Springs, CO, March 30, 2004.

German space budget for 2006 was approximately 1.2 billion euros.[44] Germany lacks a single strategic view for space and national level space activities in Germany are fragmented. The German Ministry of Transport, Building and Urban Affairs has authority over issues related to Galileo. The Federal Ministry of Economics and Technology has authority over German civil space activities through Germany's Space Agency, the German Aerospace Research Center (DLR). DLR plans the German civil space program, implements German space-flight activities, and represents Germany's space program internationally. DLR is not involved in the German Ministry of Defense SAR-Lupe radar imaging satellite program. SAR-Lupe is the first ever military satellite system developed by Germany and has been a technological success since the launch of the first satellite in December 2006.

Germany supports the integration of European space activities at the European-level but has some reservations. First, the potential weakening of the ESA *juste retour* rule means less return on investment to Germany. Whereas France sees a benefit to its industry in this regard, Germany sees a net loss nationally. Second, as the second largest contributor, Germany enjoys an influential and powerful position in ESA. DLR has weight in decision making at ESA but will only be able to provide advice to the EC. This is the big difference between IGO-level European space projects and European-level projects. At ESA, each country has one vote. ESA, as an IGO, just implements whatever decisions the ESA Member States agree upon. ESA has no independent decision making

[44] Uwe Soltau, "How DLR Supports German Companies in Winning Contracts with ESA and the EU," (lecture presented at 3rd Workshop SineQuaNet, ESOC Darmstadt, GE, August 2, 2007). http://esamultimedia.esa.int/docs/industry/SME/SineQuaNet-workshops/Darmstadt-8feb07/10_Soltau_How-DLR-supports-German-companies-in-winning-work-with-ESA-and-the-EU.pdf (accessed January 10, 2008).

authority.[45] The EC on the other hand has wide decision making authority. Member States can provide their inputs, but they won't have as much weight in decision making. This is a concern to Germany.

As mentioned previously, Germany is cooperating bilaterally and multilaterally with other European states in security space activities. The data sharing agreement with France between the SAR-Lupe and Helios Earth Observation systems; the 2002 framework agreement between France and Germany to develop cooperation and define a strategic blueprint for a strong European Space industry; and the multi-lateral COR initiative for the development of future space reconnaissance systems are initiatives well under way.

German space activities contribute a large portion of the overall European experience, expertise, and expenditure on space. It almost goes without saying that for European-level space activities to not only succeed, but to grow, German support is a prerequisite. This includes German support for Galileo. If Germany were to put obstacles in Galileo's path, the endeavor would be seriously threatened.

The Italian Space Program: The Italian Space Agency, Agenzia Spatiale Italiana (ASI), was created in 1988 under the control of the Ministers for Universities and the Coordination of Scientific and Technological Research, who in turn, operate within the guidelines set by the inter-ministerial Italian Economic Planning Committee. ASI is a purely civil agency, and the military is not involved in its affairs.[46] The ASI annual

[45] Ralf Huber, interviewed by author, Colorado Springs, CO, March 30, 2004.
[46] Kevin Madders, *A New Force at a New Frontier* (Cambridge: Cambridge University Press, 1997), 494.

budget is about 650 million euros with at least 60 percent traditionally being devoted to ESA.[47]

The United Kingdom Space Program: British national level space activities are arranged around a national space policy focused intently on space commerce and on improving the quality of life of the United Kingdom's citizens. The United Kingdom spent 207 million pounds on space programs in the 2006 fiscal year with 65 percent of those space expenditures going directly into ESA and the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) programs.[48] The United Kingdom is the fourth largest contributor to ESA overall.

But the United Kingdom was also perceived to be conspicuously absent from the French, German and Italian led push for more cooperation and integration at the European-level and it has been the most skeptical of the Galileo program.[49] The United Kingdom stated in its 2003 Space Strategy that it is favored strengthened links with ESA and the EU, actively supported a closer relationship between the ESA and EU, and promoted development of a common European strategy for space. However, the United Kingdom also stated that it was officially "*concerned*" with suggestions that the EU should invest in a comprehensive range of space programs.[50] It shared the same concerns

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[47] Peter B. de Selding, "Italian Funding Shift Cast Shadow on ESA Initiatives," *Space News* (October 3, 2008). http://www.space.com/spacenews/spacenews_summary.html#BM_5 (accessed October 9, 2008). In late 2008 the Italian government decide to reduce its financial commitment to ESA in coming years.
[48] BNSC, "How We Work." http://www.bnsc.gov.uk/content.aspx?nid=5589. (accessed February 15, 2008).
[49] ESA official, interviewed by author, Paris, France, September 17, 2007.
[50] British National Space Center, *UK Space Strategy: 2003-2006 and Beyond*, (London: BNSC, December 2003), 33. A new UK Space Strategy was released in early 2008 but it did not express the same concern. BNSC, *UK Civil Space Strategy: 2008-2012 and Beyond*, (London: BNSC, February 2008).

as the Germans regarding the loss of influence in decision-making within ESA verses the EC and the weakening of the ESA *juste retour* rule.

The British are also reluctant to contribute through EU financial structures to European-level security space activities. The United Kingdom takes the position that those type of activities belong at the national level. Moreover, the United Kingdom doesn't see the benefit to them because, in fact, the United States already provides them most of the resources to fulfill their security space requirements.[51]

The organization of the U.K. space sector is significantly different from other major European countries. The United Kingdom does not even have a true civil space agency.[52] Instead, the British National Space Center (BNSC) has only about 45 staff members and is strictly a coordinating body bringing together the three primary space communities in the United Kingdom: government, industry, and academia. Even though BNSC is the core for coordination of the U.K. space sector, it does not have its own budget.[53] BNSC is a voluntary partnership of ten government departments, agencies, and research councils with interests in civil space.[54] BNSC receives its funding through contributions by these entities and the BNSC in turn provides the interface for these entities for interaction with ESA, the EU, NASA, and other international partners.[55]

After reducing its ambitions for leadership in European space activities relatively early in the space age, the United Kingdom was slow in developing a formal space policy. It was only with the Blair government that the first U.K. civil space policy was

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[51] Istituto Affari Internazionali, *International Report on Space and Security In Europe*, 106.
[52] L. Cucit and others, "Management and Organizational Models of the European Space Agencies: the Results of an Empirical Study," *Technovation* 24, (2004): 3.
[53] Shirvanian, ed. *2004 European Space Directory*, 48.
[54] "What is BNSC," http://www.bnsc.gov.uk/content.aspx?nid=5543 (accessed February 15, 2008)
[55] BNSC, *UK Space Strategy: 2003-2006*, 2, 7-8.

formulated in 2003.[56] Following a review of BNSC in 2002, a U.K. Space Strategy Council was formed to provide strategic guidance to the government bodies which comprise the BNSC and provide advice on strategy and policy to the BNSC Director General.[57] It met for the first time in December 2002. It released the *UK Space Strategy, 2003-2006 and Beyond* in December 2003, coinciding very closely with the release of the EU *White Paper* on space and the EU/ESA *Framework Agreement*. In February 2008, a new United Kingdom Space Strategy, *UK Civil Space Strategy: 2008-2012 and Beyond*, was released; however this strategy document falls outside the timeframe of this study.[58]

The Space Strategy Council was superseded by the Space Advisory Council after another reorganization in early 2005.[59] The U.K. Space Board was also created at that time. Its membership is a subset of the Space Advisory Council membership and consists of those organizations that provide the main funding for British space activities. The U.K. Space Board provides BNSC with advice on policy and is responsible for the overall performance of the BNSC partnership.

The U.K. Space Advisory Council, the U.K. Space Board, BNSC, and the U.K. Minister for Space are organizationally set at a relatively low political level. The Minister for Science and Innovation is also the Minister for Space since space falls within his portfolio. The Director General of the BNSC reports to the Director General of the Innovation, Universities and Skills in the Department of Trade and Industry. The U.K. Space Advisory Council is also chaired by the Director General of the Innovation Group

[56] Taylor Dinerman, "Future British Military Space Policy," *Space Review*, (April 12, 2004) http://www.thespacereview.comarticle/129/1 (accessed August 14, 2004).
[57] "First Meeting of the UK Space Strategy Council." BNSC Press Release, December 6, 2002. http://www.spaceref.com/news/viewpr.html (accessed February 15 2008).
[58] BNSC, *UK Civil Space Strategy: 2008-2012 and Beyond*. A detailed examination of this strategy is outside the scope of this study.
[59] BNSC, "Space Advisory Council," http://www.bnsc.gov.uk/content.aspx?nid=5595, (accessed February 15, 2008).

in the Department of Trade and Industry. Its membership is made up of all member government organizations and space industry and service representatives. The British Ministry of Defense does not have an official body, agency, or branch of service dedicated to military space.[60]

The fragmented organizational structure of U.K. space activities, its diluted and convoluted funding mechanisms, and its apparent political weakness due to its relatively low political level demonstrates that the United Kingdom does not view space activities as strategically as France.[61]

The Surrey Space Center is an important commercial space sector entity in the United Kingdom and has attained worldwide renown for its research, development, and operation of small satellites. The Surry Space Center is a cooperative and fully integrated relationship between University of Surrey research teams and the University of Surrey's commercial company, Surrey Satellite Technology Limited (SSTL). Thus the Surrey Space Center is a good example of the interrelationship among the three primary space communities in the United Kingdom: government, industry, and academia.

SSTL attained a new level of competence and prestige when in July 2003 ESA awarded it a contract to build the first satellite in the Galileo program, called GIOVE-A. SSTL's capabilities were demonstrated when GIOVE-A was successfully placed in orbit in December 2005, becoming the first satellite in the Galileo constellation and remaining the only Galileo satellite in orbit at the end of the period under study.

U.K. space policy, organization, and funding have not reached the levels they have in the EC, in France, in Germany, or in Italy and may reflect reluctance by the

[60] Istituto Affari Internazionali, *International Report on Space and Security In Europe*, 107.
[61] Ibid., 106.

British to get fully behind the effort to integrate European space activities at the European-level, including the Galileo project. Additionally, at the national level it may indicate a certain lack of recognition of the benefits of space by top policymakers. It would be a significant shift domestically and for the EU if the United Kingdom ever raises space to a higher political, organizational, and financial level. Such a move may signal a recognition and acceptance of the benefits of space. Such recognition may have implications for the future growth and success of European-level space activities including Galileo. Understanding the organization, interests and space activities of the United Kingdom provides important context for understanding the Galileo program.

2. Key Definitions:

In order to grasp the context that the Galileo project operates within it is not sufficient to appreciate only the organizational structures, policies, and funding of the various levels within the European space sector. It is also important to have a grasp of the terminology and paradigms with which European decision-makers grapple with Galileo issues. A few simple space policy frameworks and definitions are offered below in order to provide the conceptual foundation needed to fully grasp the Galileo case.

<u>*Space Policy Frameworks*</u>: There are three relevant space policy frameworks for understanding space activities and associated capabilities. In the first framework, space activities may simply be divided into three types: human spaceflight activities; scientific-space activities; and space application activities. The general public most often equates space programs with *human spaceflight* since it is the most visible space activity.

Current NASA efforts to resume manned missions to the Moon, the construction and operation of the International Space Station (ISS), and Space Shuttle flights represent this type of activity by the United States. *Scientific-space* activities refer to such programs as sending space probes to other planets, such as the Mars rovers, and using spacecraft to make scientific observations of the earth, sun, galaxy, or universe. *Space application* activities refer to services provided by satellites to people on the Earth. Communication satellites, navigation satellites such as GPS and Galileo, Earth observation satellites (e.g. weather satellites), and military and intelligence satellites are examples of satellites which provide such services. Space application activities are often unnoticed or taken for granted by the public, although they have become intertwined with all levels of the economy and society. GPS signals are enmeshed so much so, as a matter of fact, that they are sometimes referred to as global utilities as mentioned in Chapter One and discussed in more detail in Chapter Four. This dissertation focuses on one space application program, Galileo, and does not discuss human spaceflight and scientific-space activities.

The second space policy framework for understanding space activities separates the space sector into three primary subsets, civil space, commercial space, and national security space (also simply called security space).[62] In the United States, national

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[62] Pete Hays notes that many United States Government documents list three space sectors. Upon closer examination, however, he notes that these documents reveal four sectors. For example, the 1996 National Space Policy discusses civil, national security (defense and intelligence), and commercial sectors. National Science and Technology Council, "Fact Sheet: National Space Policy," (Washington, DC: The White House, September 19, 1996). Pete Hays also noted that the term "space sectors" was first used as an organizing typology in President Jimmy Carter's 1978 National Space Policy. National Security Council, *Presidential Directive/NSC-37: National Space Policy,* (Washington, DC: The White House, May 11, 1978). From Pete Hays, "What is Space Power and Does it Constitute a Revolution in Military Affairs? *Journal of Military and Strategic Studies*, (Fall 2002), Footnote 6. http://www.jmss.org/2002/article1.html (accessed February 15, 2008). Interestingly the 2007 European Space Policy does not use this framework.

security space is commonly subdivided into defense space, (also called military space), and intelligence space.

Civil space involves programs funded, managed, and implemented by the government, usually for human spaceflight, scientific-space activities, and public good space application activities. NASA and the operation of the Space Shuttle and International Space Station are good examples.

Commercial space refers to space application activities privately financed, managed, implemented and operated by commercial interests to make a profit. Echostar's DISH satellite TV network is an excellent example.

National Security space refers to military and intelligence space application activities funded, managed, and implemented by national security sector actors including the U.S. Air Force and the National Reconnaissance Office (NRO), for example. More specifically, *military space* refers to the operational and tactical level use of space applications for warfighting purposes. *Intelligence space* connotes a more strategic-level use of satellite applications to provide top national security decision-makers with strategic information, although significant effort has been made in the United States to allow such information to flow to the battlefield, as appropriate. The French use the information from their military's Helios surveillance satellites primarily to provide strategic information to top political leaders. So even though it is a military satellite system, its purposes may be more strategic and political than for tactical-level military use.

This framework's usefulness is beginning to erode. Satellites that perform functions for more than one space sector; civil, commercial, or national security, or for

more than one purpose, are becoming more common and are called dual-use, or multi-use, satellite systems. Dual-use satellite systems have gained favor since the end of the Cold War due to their cost effectiveness and the rise of the commercial space sector.[63] For example, a satellite capability developed primarily for "civil" applications, such as weather forecasting, may be used simultaneously for scientific studies or may also be used by military forces to increase military effectiveness. Galileo's multi-use capabilities are a large part of the reason it has faced so many obstacles in its development. Is it a civil system, a commercial system, or a space system with national security uses? Of course, it is all three, and the controversy surrounding this fact demonstrates the inadequacy of this old framework.

ESA uses another framework to classify European space activities. The ESA framework is the de facto framework for the entire European space sector since neither the EU nor any ESA or EU Member States have articulated an alternate framework. ESA divides its space activities into three categories: Basic, Inspirational, and Utilitarian.[64]

"Basic" space includes all the basic space capabilities necessary to guarantee strategic independence in the space realm. This includes an autonomous launch capability, satellite and sensor manufacturing, and the requisite technological and industrial capabilities that must be maintained in order for an independent space program to exist.

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[63] L. Cucit and others, "Management and Organizational Models of the European Space Agencies: the Results of an Empirical Study," *Technovation* 24, (2004): 3. Also see Johnson Freese, *Space as a Strategic Asset*, and Lungu, "Power, Techno-Economics, and Transatlantic Relations,"
[64] Battrick, ed., *Agenda 2007*, 11.

"Inspirational" space activities involve exploration, human spaceflight, and some scientific space activities.[65]

"Utilitarian" includes space application activities which may be either publicly or privately financed, developed, and operated.[66] It is important to remember that until the last few years, ESA was very strict about not participating in activities that involved military or intelligence space activities. This is changing however.

The simple space policy frameworks outlined above describe the frameworks within which European decision-makers grapple with Galileo issues and are offered in this section in order to provide some concepts needed to fully grasp the Galileo case.

3. GPS and Galileo overview:

GPS design, technology, operations, and services established the precedent for global navigation satellite systems. As the GPS program and technology matured, observers in Europe noted its technological shortcomings and design constraints. With the benefit of that knowledge, the Galileo program was designed such that it would provide better, more reliable PNT information than GPS. In effect, the Galileo program design played off of GPS in many ways. Therefore, in order to explain Galileo comprehensively, it is necessary to provide an overview of some of the terminology associated with GPS and some organizational and technical aspects of GPS.

<u>The Navstar Global Positioning System (GPS)</u>: The Global Positioning System is owned, operated, and paid for by the U.S. Air Force, although it has become a multi-use system

[65] Ibid
[66] Ibid

with major civil and commercial users. It consists of a minimum of 24 operational Navstar satellites in 12 hour orbits at an altitude of 12,000 miles. These 24 satellites are referred to as the GPS "constellation." The Navstar satellites continuously broadcast precise timing signals over the face of the Earth and even out into space. Receivers in view of the satellites use the signals to calculate their position and velocity. The accuracy of the receiver's calculations increases with the number of satellites' signals it is receiving, since it is able to triangulate its position better. The receiver must be able to receive signals from four different satellites in order to calculate its velocity. Each GPS Navstar satellite broadcasts two different types of signals. The "Civilian/Acquisition" signals, "C/A code," is available for free for use by civilians and is also used to acquire the Navstar's more "Precise" signal, the "P-Code." The P-code is for use by the U.S. military and NATO. The P-code can also be received by civilians. However, the P-code's accuracy can be artificially adjusted by U.S. Air Force GPS operators through the use of "Selective Availability" so that civilian receivers can not derive the most precise signals. These signals are also labeled, respectively, as the Standard Positioning Service (SPS) and the Precise Positioning Service (PPS).[67] The newest GPS satellites, launched from 2003 onward, also carry a new military signal called the M-code which is more jam resistant than the P-code signal.[68]

GPS satellite designs have been upgraded over the 30 year course of the program. The satellites are designed and acquired in "Blocks." Some older GPS satellites have exceeded their design life and remained operational while newer satellites were launched.

[67] Rosalind Lewis and others, *Building a Multinational Global Navigation Satellite System: An Initial Look*, (Santa Monica: RAND, 2005), 19.
[68] Gustav Lindstrom and Giovanni Gasparini, *The Galileo Satellite System and its Security Implications*, Occasional Paper No 44, (Paris: European Union Institute for Security Studies, 2003), 11.

The result is a mixed constellation of older, less capable satellites with newer more capable satellites. GPS blocks include Block I, Block II, Block IIA, Block IIR, and Block IIR-M. Block III (also known as GPS III) is currently scheduled to be launched beginning in 2012.

GPS Selective Availability (SA): SA is the method used to reduce the accuracy of GPS signals by, simply put, introducing false information into the GPS P-code signal stream. This capability is designed to prevent unauthorized users from benefiting from GPS' most accurate signals – for either commercial or malicious reasons. Authorized users' receivers can remove the false information from the signal stream through a decoding process. When SA is enabled, GPS receivers that are unable to filter out the error are accurate to roughly within 100 meters. SA was enabled for the first time on March 25, 1990. In September 1990 SA was disabled for Operation Desert Storm so that United States and allied forces could rely upon civilian GPS receivers, since there was a severe shortage of the military receivers which could filter the error out of the SA-enabled P-code. On July 1, 1991 SA was turned back on.[69]

In March 2000, President Clinton ordered that SA be disabled again, and it has remained disabled up until this time.[70] (The significance of this decision is discussed in the chapters below). Even with SA disabled, however, the GPS signal still contains some error due to ionospheric interference and imperfect satellite orbital position data. The method for eliminating these signal errors, and even errors introduced by SA, is referred to as "Differential GPS."

[69] Hays, "What is Space Power and Does it Constitute a Revolution in Military Affairs?" footnote 99.
[70] Presidential Memorandum "Direction to Discontinue the Use of Selective Availability," April 28, 2000.

Differential GPS: Differential GPS (DGPS) refers to methods used to "augment" or "overlay" GPS signals to provide greater accuracy, availability, and reliability. "Augmentation" or "overlaying" is the technique of using ground reference stations, at precise locations, to correct GPS signals. After receipt of the GPS signal, the ground reference station system calculates the amount of error in the GPS signal by comparing the station's precisely known location with the estimated location provided by GPS. The error in the GPS signal is removed and the corrected GPS signals are rebroadcast via ground-base transmitters or transmitters on telecommunication satellites in geostationary orbit. DGPS is able to achieve positioning accuracy of much less than one meter. This also means that DGPS negates the error introduced by Selective Availability, thereby rending SA useless in areas that have DGPS available. DGPS also acts as a GPS signal integrity monitor. The U.S. Federal Aviation Administration built the Wide Area Augmentation System (WAAS) to "augment GPS" for aviation and public safety purposes, and many other countries are creating their own Differential GPS networks for similar purposes. The Global Navigation Satellite System - 1 (GNSS-1) concept, described below, is based upon DGPS, as is the European Geo-stationary Navigation Overlay Service (EGNOS).[71]

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[71] Scott Pace, "Merchants and Guardians: Balancing U.S. Interests in Space Commerce," in *Balancing National Interests in Space Development*, International Space Policy Forum, Washington DC, George Washington University, Elliott School of International Affairs, (1999), 40. Also available as Scott Pace, "Merchants and Guardians: Balancing U.S. Interests in Space Commerce," in John Logsdon and Russell Acker, eds., *Merchants and Guardians* (1999) and as a RAND Reprint, (1999).

GNSS-1 and GNSS-2: GNSS is a generic name for a global civil navigation satellite system which satisfies civil user requirements, particularly transport services, rather than military requirements. GNSS-1 is the first generation GNSS which relies upon augmenting GPS signals through differential GPS techniques (described above). GNSS-2 is envisioned as the second generation GNSS and will be a completely civil, global navigation satellite network. It will be completely autonomous and not depend upon any military controlled satellite system, such as GPS or GLONASS.[72] Galileo is envisioned as Europe's contribution to GNSS-2. Galileo was originally slated to be operational by 2008, but due to many obstacles outlined in the coming chapters, it is currently scheduled to be operational in 2013.

European Geostationary Navigation Overlay Service (EGNOS): Europe's contribution to GNSS-1 is EGNOS. EGNOS is a combined project between the EC, ESA, and the European Organization for the Safety of Air Navigation (EUROCONTROL). EGNOS entered its pre-operational phase in 2006. In short, EGNOS is a European differential GPS system. It uses three International Maritime Satellite Organization (Inmarsat) geostationary satellites and a network of ground stations to transmit information on the reliability and accuracy of GPS navigation signals,[73] and Russia's Global Orbiting Navigation Satellite System (GLONASS) navigation signals.[74]

[72] Commission, "Global Navigation Satellite System - High Level Group."
[73] Lindstrom and Gasparini, *The Galileo Satellite System and its Security Implications*, 14.
[74] EGNOS also augments GLONASS. A discussion of GLONASS is beyond the scope of this report.

Galileo: The last building block needed in order to lay the foundation for the detailed examination of the Galileo program is a high-level overview of important technical and organizational attributes of the Galileo program.

Galileo signals will be more accurate than GPS, be more available, and meet stringent legal requirements for liability including providing near real-time information on signal integrity, a capability which GPS lacks. The Galileo constellation will consist of 27 satellites plus three on-orbit spare satellites in medium Earth orbit, (14,600 miles), at an inclination of 56 degrees. In addition to its PNT capabilities, Galileo will have a capability to detect and re-transmit search and rescue signals.[75] Galileo plans to transmit five separate signals including: 1) Open service (OS) which will be free but have no service guarantee and no liability; 2) Safety-of-life (SoL) service which includes a service guarantee for SoL applications, integrity notification, and signal authentication; 3) Public Regulated Service (PRS) which will be an encrypted and fee-based PNT signal for the military, police, fire, ambulance and other public users. PRS must be available at all times and under all circumstances. This signal is the most controversial due to its strategic nature, similar purpose as the GPS P-code, and lack of commercial applicability; 4) Commercial service which will be an encrypted and fee-based PNT signal for commercial market applications, and will provide a service guarantee and 5) Search and Rescue (SAR) service which will relay distress alarms to improve existing search and rescue methods.[76]

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[75] Benedicto, J., Dinwiddy, S., Gatti, G., et al, "Galileo: Satellite System Design and Technology Developments," European Space Agency, November 2000. http://esamultimedia.esa.int/docs/galileo_world_paper_Dec_2000.pdf (accessed January 12, 2008).

[76] Rosalind Lewis and others, *Building a Multinational Global Navigation Satellite System: An Initial Look*, (Santa Monica: RAND, 2005), 19-20.

The EC and ESA chartered the Galileo Joint Undertaking (GJU) in 2002 to manage the project. The GJU managed the program from May 2002 until December 2006, when the GJU ceased to exist and its responsibilities were transferred to the European GNSS Supervisory Authority (GSA).

Since January 2007 GSA has managed the Galileo and EGNOS programs. GSA is responsible for implementing and managing Galileo's deployment and operating phases. Its responsibilities and tasks include: financial management, regulatory authority, certification, frequency management, licensing concession holders, integrating Galileo with EGNOS, managing relationships and agreements with ESA and the private sector, and managing all aspects of system safety and security. The GSA System Safety and Security Committee is composed of security experts with one representative from each Member State and one from the European Commission. One representative from the EU's second pillar and one representative from ESA attend the meetings as observers.[77]

4. Conclusion:

A basic understanding of the structure of the European space sector, common space policy frameworks, GPS, and the Galileo project are prerequisites for comprehending the analysis in the following chapters. The building blocks outlined above provide the foundation upon which this study launches into the detailed examination of the Galileo program.

[77] European Union, "Council Regulation (EC) 1942/2006 of 12 Dec 2006: Amending Regulation (EC) No 1321/2004 on the Establishment of Structures for the Management of the European Satellite radio-navigation programmes, *Official Journal of the European Union*, (Brussels: December 22, 2006), 20.

Chapter Three:
Methodology

1. Overview: This study seeks to determine the relative weight of the motives driving the Galileo program, at four points in time, in order to help explain the Galileo program's ability to survive until now. First, the many commonly accepted motives for Galileo are provided below. However, the multi-use nature of Galileo and the complex mix of actors involved in the project impair our ability to see clearly which of these many motives have carried the most weight. Therefore, this study attempts to clarify which motives carried the most weight by using three perspectives from international relations theory: realist, liberal, and ideational. Key aspects of these perspectives are outlined below and three hypotheses, one for each perspective, are introduced. To test these hypotheses, many indicators of the presence of factors associated with each perspective are also identified below. The most important indicators include the civil, defense, or commercial nature of organizations deeply involved in initiating and managing the project; the civil, defense, or commercial nature of the sources of money for the project; and the civil, defense, or commercial nature of the decision-makers with the most control over the project.

The evolution of the Galileo program is described and an analysis of the indicators is done at: 1) The 1999 EU decision to pursue an independent navigation satellite capability and the approval of the "Definition Phase" of Galileo; 2) The March 2002 EU decision to continue to back Galileo and the approval of the Galileo "Development Phase"; 3) The June 2004 agreement between the European Union and the United States to make Galileo and GPS compatible and interoperable; and 4) The 2007 EU decision to fund Galileo's "Deployment Phase" entirely from EU public funds.

Indicators are categorized as either realist, liberal, or ideational, and a subjective analysis attempts to deduce which factors weighed the most heavily on European decision-makers' minds. However, the unique array of political actors and levels in Europe makes it difficult to discern the level from which the major impetus for Galileo came. Therefore, an additional step is taken which considers the relative influence of the international level, European level, national level, and industrial level. By this means, we are able to make an informed judgment – but still a judgment -- about the significance of each level.

Many trends converged in the 1990s which produced a new impetus for an independent European navigation satellite system. These trends include: increasing EU interest in space and security affairs, the growing commercial space sector, the consolidation of the aerospace industry, the growing popularity of Public-Private Partnerships, and growing doubts about ESA. The most important trend, however, was the rapidly increasing integration of navigation satellite signals into all sectors of society. In the course of the 1990s navigation satellites became crucial enablers of the modern global information infrastructure.

The chronological study of the Galileo program draws out the various factors, levels and trends influencing European decision-makers and provides us a better understanding of the relative weight of the motives behind Galileo at each decision point, and enables us to see if the motives changed over time. This insight will help to explain Galileo's ability to survive in spite of the many obstacles outlined in the introduction to this study. However, since the scope of this study is broad, with Galileo involving many actors and with many key decisions over the last ten years, I use selective judgment to

limit the scope of the study to only the most significant factors and the most relevant actors and decision-makers. While this study cannot provide definitive answers, it may help us better understand Galileo's ability to endure.

2. Drivers: As detailed in Chapter One's literature review, participants and observers have identified a variety of motives behind the Galileo program including: European sovereignty, independence, and autonomy; commerce, global market shares, competitiveness, employment, civil infrastructure, and the efficiency of the transport industry; new services for citizens that are better than GPS, improved safety of transport systems; environmental and technological benefits; its use as a bargaining chip for pressuring the United States to remove Selective Availability from GPS; as an economic tool to asymmetrically balance against American hegemony; and as an example of international cooperation to counterbalance the "American aerospace advantage." The literature regarding Galileo contains little information about the relative importance of this jumble of drivers. Clearly, Galileo's multi-use capabilities and the diversity of actors involved in the program cause confusion and controversy about the rationale for Galileo and obscure the relative weight of the motives behind European decision-makers' assessments of the need for Galileo.

3. International Relations Theory: This study attempts to clarify the situation by using three perspectives derived from international relations theory; the realist, liberal, and ideational. The chronological study of the Galileo program will reveal indicators of the presence of these factors. Once the factors are revealed they will be "placed" into the

realist, liberal, or ideational category in which they fit best. This helps to bring to light the relative weight of the factors influencing European-decision makers' assessment of the need for Galileo. In addition, the realist, liberal, and ideational perspectives help to identify what evidence should be looked for in the first place. Key aspects of these perspectives are outlined below and three hypotheses, one for each perspective, are introduced.

<u>The Realist perspective:</u> Realism uses the state as its basic unit of analysis since states are the highest form of political organization today, although in the past it was the tribe, the kingdom, or the empire; this demonstrates that the form of the highest political organization may change overtime. This study when discussing factors at the international level treats the European Union analytically "as if" it were a state, since in many areas it acts as if it is a state in the international system, and especially with regard to Galileo. That being said, realism begins with the assumption that the international system is anarchic and therefore conflictual by nature. As a consequence, states rely upon self-help in order to maintain sovereignty and survive. Therefore, the acquisition and maintenance of power in order to get security is the primary motivation of the state.[1] Since all states try to maximize power and perceive (or misperceive)[2] the amount of power other states possess, balancing power is the preferred means to maintain stability

[1] Robert Gilpin, "The Richness of the Tradition of Political Realism," in *Neorealism and Its Critics*, ed. Robert Keohane, (New York: Columbia University Press, 1986), 305 and 314.
[2] Robert Jervis, *Perception and Misperception in International Politics* (Princeton, New Jersey: Princeton University Press, 1976).

and avoid conflict. This is accomplished by increasing internal economic capability or military capability (internal efforts) or through the creation of alliances (external efforts).[3]

The measure of a state's power is taken from assessing its material capabilities. Material capabilities in turn, are determined by measuring a state's military strength, economic capability, resources, population, territory, political stability, and competence.[4] The capabilities that Galileo provides are not related to "population" and "territorial" measures. In addition, Galileo's contribution to "political stability" and "competence" fits better analytically under the *ideational factors* category in this study, if at all. Thus, in the category of "realist factors," most attention is given to considering Galileo's contribution to European military strength, economic capability, and resources.

"Military strength" is the most important measure for determining a state's material capabilities according to the realist perspective. The other measures outlined below are significant in so far as they contribute to the military strength of a state.[5] Therefore, this study considers indicators which link Galileo to military strength and defense as the strongest indicators that realist factors weighed the most heavily in European decision-makers' assessments of the need for Galileo. The degree to which military and defense considerations and military and defense resources are found to permeate the Galileo program, or not, is the most useful indicator of how heavily realist

[3] Kenneth N. Waltz, "Theory of International Politics," in *Neorealism and Its Critics*, ed. Robert Keohane, (New York: Columbia University Press, 1986), 117.
[4] Kenneth N. Waltz, *Theory of International Politics* (New York: Random House, 1979), 131.
[5] The realist perspective emphasizes that military strength is what matters most. John Mearsheimer in *The Tragedy of Great Power Politics*, equates power with military capability throughout Chapter 9, "The Causes of Great Power War." John Mearsheimer, *The Tragedy of Great Power Politics,* (New York: W.W. Norton, 2001) 334-359. E.H Carr in *The Twenty Year Crisis* on page 109 states that "Powers are graded according to the quality and the supposed efficiency of the military equipment at there disposal." Of the material capabilities noted above, the European Union only lacks military strength. Nevertheless, this makes the EU weak from a realist point a view. This point is emphasized by Christopher Hill "The Capabilities-Expectations Gap, or Conceptualizing Europe's International Role," *Journal of Common Market Studies* 31, no. 3 (September 1993): 306.

factors weigh in European leaders assessment of the need for Galileo. Galileo's multi-use nature, the numerous actors involved in Galileo decisions, and the EU and its Member States' inability to talk forthrightly about military and defense issues at the European Union clouds the analysis, however, and makes it difficult to deduce military drivers. In addition, the definition of "security" expanded after the Cold War, diluting its traditional military-oriented meaning. This makes it necessary to precisely define the term when using it as an indicator. The various definitions of "security" will be discussed in a moment. In short, this study considers indicators of military and defense-establishment involvement in Galileo, or the lack thereof, as the most important indicator for gauging the significance of realist factors.

"Economic capabilities" from a realist perspective focuses on economic strength as a political lever, and as the foundation for military power. In this perspective the pursuit of wealth and the pursuit of power are indistinguishable.[6] E.H Carr tells us that throughout modern history there has been an increasingly intimate association between military and economic power.[7] However, Kenneth Waltz argues that economic gains are subordinate to security considerations.[8] Therefore, evidence that shows that security considerations overrode economic considerations in the Galileo program would be strong realist indicators. In addition, references which link Galileo's economic potential with Europe's security, defense and survival will be categorized as realist economic factors. In contrast and as discussed below, this study will consider reference to economic factors

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[6] Jacob Viner, 1948, in "The Richness of the Tradition of Political Realism," by Robert Gilpin, in *Neorealism and its Critics*, (New York; Columbia University Press, 1986): 309.
[7] Edward.H. Carr, *The Twenty Years Crisis, 1919-1939: An Introduction to the Study of International Relations*, (New York: St. Martin's Press, 2001), 113.
[8] Kenneth N. Waltz, "Theory of International Politics," in *Neorealism and Its Critics*, ed. Robert Keohane (New York: Columbia University Press, 1986): 104.

that focus on interdependence, economic cooperation, efficiency, comparative advantage, and the role of international organizations in helping states maximize returns and produce public goods as liberal factors.

The "resources" that Galileo will provide: i.e. precision positioning, navigation, and timing information, are not what are traditionally meant by "resources." But in the "information age" it is not unreasonable to consider the PNT information that GPS currently provides, and that Galileo will provide in the future, as a vital resource economically and militarily, and thus an important component of a state's material capability. Control of this key resource, therefore, takes on a strategic political dimension. As noted previously, navigation satellite signals are vital enablers of the modern global information infrastructure and critical enablers of modern military capabilities. Concerns about the need for independent control over these modern information resources, and references to Galileo's signals as essential resources for everyone, at all levels of society, and across multiple sectors of society, will be categorized as realist factors.

The realist perspective further holds that international organizations are merely extensions of the states that created them, especially the most powerful states, and are not capable of independent action in international affairs.[9] They almost exclusively reflect Member States' interests. The decision-making roles of ESA and the European Commission versus the role their Member States played in the Galileo program will be considered in this study in order to determine what extent these organizations had the

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[9] John Mearsheimer, "The False Promise of International Institutions," *International Security* 19, no. 3 (Winter 1994-1995): 7.

ability for independent action, and if they were able make decisions which diverged from Member States' perceived interests. If not, the realist perspective will be bolstered.

This study will use these fundamental tenants of the realist perspective in order to derive indicators that realist factors drove European decision-makers' assessments of the need for Galileo.

At this point a brief discussion of "autonomy" is necessary because on its face, the term "autonomy" seems to have strong realist overtones. However, both realist and liberal perspectives conceive of states as "unified rational autonomous actors."[10] Therefore, the French desire for autonomy, which has been transferred in many respects to the European Union, does not necessarily get classified by this study as a realist indicator. Furthermore, "autonomy" is often used interchangeably with the words "sovereignty" and "independence." However, while the legal and theoretical definitions of sovereignty have been examined and debated extensively, the term "autonomy" seems to mean many things. A few of the usages uncovered in this study include mention of: strategic autonomy, technological autonomy, political autonomy, scientific autonomy, economic autonomy, industrial autonomy, and cultural autonomy. This study did not uncover any international relations scholarship which investigated the meaning of "autonomy" directly, although Stephen Krasner refers to the "norm of autonomy" as "the core of Westphalian sovereignty."[11] In addition, this study uncovered no theoretical link which binds "autonomy" primarily with the realist perspective. The best we could do is note that the term "autonomy" is sometimes used in contrast to the concept of "interdependence." In sum, because the term "autonomy" is generic and both the realist

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[10] Stephen D. Krasner, *Sovereignty: Organized Hypocrisy* (Princeton: Princeton University Press, 1999), 6.
[11] Stephen D. Krasner, *Sovereignty: Organized Hypocrisy* (Princeton; Princeton University Press, 1999), 8.

and liberal perspectives conceive of the state as autonomous, this study contends that the term "autonomy" is insufficiently precise to be useful and, therefore, does not give it great significance as an indicator of whether European decision-makers' assessments of the need for Galileo were driven more by realist or liberal factors.

Likewise, the term "strategic" has realist connotations but is also a nonspecific term which is of limited use as an indicator. The U.S. Department of Defense lists 28 different uses of the word "strategic," referring to everything from nuclear weapons, to intelligence, to communications, to bombing campaigns and so on.[12] While Galileo's "strategic" importance is often emphasized by the European Commission, and seems to imply a latent military rivalry with the United States, the use of the term "strategic" in reference to Galileo is more akin in meaning to how railways and roads are "strategic."[13] Due to such ambiguity, this study will rely upon more concrete indicators.

A precise definition of what is meant by the word "security" is also required since its meaning may have different connotations for different audiences and in different circumstances. In addition, some usages may clearly have a military and defense meaning, giving it significance from the realist perspective, while other usages may be referring to more liberal conceptions such as "human security." Therefore this study briefly reviews some definitions of security and offers a simple 'Security Continuum' in order to help us measure if a "security" aspect found in the Galileo study should weigh more as a liberal factor or as a realist factor.

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[12] Tomas Valasek, "Galileo's 'Strategic' Role," in *Europe in Space* (London: Center for European Reform, 2004), 33.
[13] Kevin Madders, interviewed by author, Brussels, BE, September 26, 2007. Also see Joan Johnson-Freese' discussion on the ambiguity of the word 'strategic.' Johnson-Freese, *Space as a Strategic Asset*, 6.

In the realist perspective, the term "security" is thought of in connection with the military defense of states' territory and interests, and in the context of interstate conflict and the threat, use, and control of military force.[14] Eventually Galileo may contribute to the military security requirements which are needed in EU Pillar Two and in Member States' militaries. The military dimension of Galileo includes any military requirements for precise navigation, positioning, and timing. This study will refer to this meaning as "military" security.

The liberal perspective accepts a broader definition of security which goes well beyond just military security threats to states, and considers military and non-military threats to the security of societies, groups, and individuals. This is referred to as "Human Security" which takes into account threats to economic, food, health, personal, political, and environmental security. The threats may come from natural sources such as natural disasters and disease, or manmade sources such as war, criminal activity and pollution.[15]

Another view of security keeps its perspective at the state-level and emphasizes the consequences of resource depletion, environmental degradation, and demographic issues on states' security.[16] In this view, such problems may cause instability and conflict due to domestic unrest, civil war, and refugee flows - especially in the developing world. The aspiration for "sustainable development" has been categorized as a method to improve security in this context.[17]

[14] Stephen M. Walt, "The Renaissance of Security Studies," *International Studies Quarterly* 35, no. 2 (June 1991): 212. Also see Roland Paris, "Human Security: Paradigm Shift or Hot Air?" *International Security* 26, no. 2 (Fall 2001): 87-102.
[15] Paris, "Human Security: Paradigm Shift or Hot Air?" 90.
[16] Jessica Tuchman Mathews, "Redefining Security," *Foreign Affairs* 68, no. 2 (spring 1989), 162.
[17] J Ann Tickner, "Re-visioning Security" in *International Relations Theory Today*, eds. Ken Booth and Steve Smith (University Park: Pennsylvania State University Press, 1995), 182.

An additional viewpoint is that security rests on economic productivity which, in turn, rests upon sound economic infrastructure.[18] Economic activity depends on efficient transportation and information networks, efficient investment in human capital, and social cohesion. For clarity, this study will refer to this frame as "economic" security. However, there is also a difference between what Americans mean by "economic security," and what Europeans mean by it. "Economic security" has both military and defense-industrial implications in the American context, whereas "economic security" has traditionally connoted primarily civilian and economic considerations in Europe.[19]

Since military security concerns have traditionally been beyond the EC's competence, as discussed in Chapter Two, in the EC references to "security" usually refer in general to economic security in the European sense, human security and environmental security as discussed above. More specifically, the EC concerns itself with natural disaster warning, mitigation, rescue, and recovery; border security; security against organized crime and terrorism; human security in terms of refugee and migrant flows; and monitoring the global environment for threats to the land, atmosphere, fresh water, fisheries, agriculture, and society in general. The EC-led Global Monitoring for the Environment and Security (GMES) space system appears to have been a response to this concept of security.

This study offers a simple 'Security Continuum' in order to help us measure if a "security" aspect found in the Galileo study should weigh more as a realist factor or as a liberal factor.

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[18] Jonathan Kirshner, *Globalization and National Security*, (New York: Routledge, 2006), 1-37.
[19] Lungu, "Power, Techno-Economics, and Transatlantic Relations," 5.

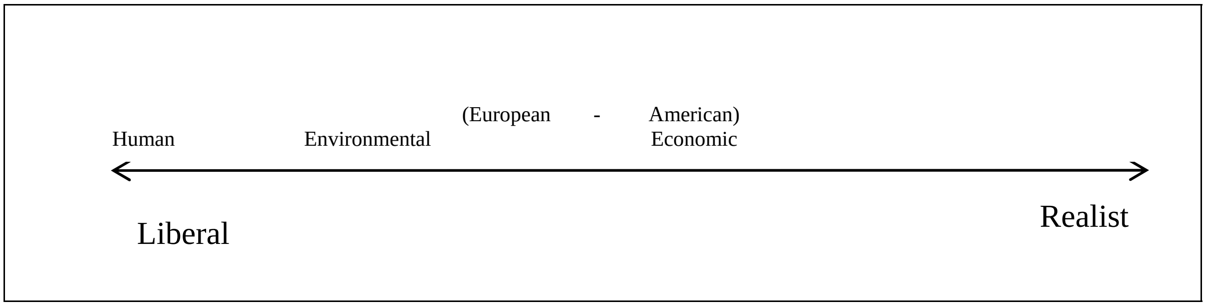

Figure 2. Security Continuum

On the right end are military security concerns which count as realist indicators. On the other end are human security factors, at the individual level, which count as liberal indicators. Environmental considerations which were considered at the state-level are in-between but closer to the liberal end of the continuum.

This study will use these basic facets of the realist perspective in order to derive indicators of the degree to which realist factors weighed on European decision-makers' assessments of the need for Galileo. In addition, the above summary of the realist perspective provides the basis for our first hypothesis:

Hypothesis A: Realist factors weighed the most heavily on European decision-makers' assessments of the need for Galileo

Realist indicators: To test Hypothesis A indicators of the presence of realist factors are identified below and then brought out in the course of this study. If realist factors were driving European decision-makers assessments of the need for Galileo this study should find that defense or military oriented organizations were deeply involved in initiating and managing the project; that money for Galileo came from defense oriented sources, and that defense officials had significant control over the project. In addition

this study expects to find actions and expressions of policy that demonstrate that key European decision-makers perceived that power is the most important tool to insure European security; that the balance of power is important; and that Galileo is a significant material capability which increases power. Other realist indicators include reference to Galileo in the context of its affect on alliances, the security dilemma, and relative power. Primary sources include: speeches, treaties, policies, conferences, agendas, goals, strategies, decisions, tasks, press releases and other forms of public expression by European leaders and European organizations.

Since the realist perspective gives the most weight to military capabilities, this study will look hard for military influences on the Galileo project. Realist indicators to look for include military and defense actors possessing approval power or veto power over Galileo design decisions and operations; military requirements having a higher priority in Galileo design than civil design requirements; any direct or indirect military inputs into Galileo's funding, organizational structure, culture, and intellectual frameworks; any plans for military authorities to hold levers of control or influence over the operation of Galileo; plans for the integration of Galileo into any European armaments; and any military exercises or war-games which simulate the use of Galileo.

Many non-military related indicators are also considered, such as Galileo funding taking priority over EU economic considerations;[20] relatively higher levels of spending on physical, information, and personnel security in the Galileo program; less international

[20] In a self-help system states place a higher priority on security considerations than on economic gain since survival and autonomy take precedence over increased well-being. See Waltz, *Neorealism and Its Critics,* 129

cooperation in order to prevent other powers from becoming militarily stronger; and more protection against technological transfers such as through tighter export controls.[21]

- Actions or expressions of policy which show that key European decision-makers consider Galileo as a material capability for increasing Europe's power.
- Military or defense nature of the organizations initiating or managing the program.
- Military or defense nature of the organizations providing funding.
- Military or defense nature of the organizations with most control or veto power over Galileo design and operation.
- Military and defense requirements having priority over civil and commercial requirements.
- Plans to Integrate Galileo receivers into armaments.
- Plans to integrate use of Galileo signals into military or security exercises.
- Direct or indirect military inputs into Galileo's organizational structure, organizational culture, and intellectual frameworks
- Galileo funding taking priority over other EU economic considerations based upon security or defense arguments.
- Absolute gains viewed negatively. Stress on zero-sum gains militarily and economically.
- Relatively higher levels of spending on physical, information, and personnel security.
- Relatively less international cooperation.
- More protection of technological transfers; tighter export controls.

Figure 3. Realist Factor Indicators

While it may not be possible in the course of this study to uncover all the possible indicators noted above, the above list may also serve as a guide for future research.

The Liberal perspective: The liberal perspective begins with the idea that, although states are the primary actors in the international system, many non-state actors matter including; International Organizations (IOs), non-governmental organizations such as advocacy groups and multi-national corporations (MNCs), and even individuals. The liberal

[21] Carr, *Twenty Years Crisis*, 111. States seek to prevent other states from becoming militarily stronger.

perspective shares the assumption of anarchy with realism, but concentrates more on how the affects of anarchy may be mitigated in order for cooperation to occur. In this regard, IOs have received significant study.[22]

IOs facilitate cooperation among self-interested states by increasing the efficiency of their interactions in three ways: they reduce transaction costs, they reduce information costs, and they reduce uncertainty.[23] They also make commitments more credible, establish focal points for coordination, and in general facilitate the operation of reciprocity.[24] In short, institutions matter. This perspective is labeled neo-liberalism, or neo-liberal institutionalism, or liberal institutionalism. It includes the crucial idea that IOs develop the ability to act independently to such a degree that they are not simply tools of the states that created them and thus merely reflect Member States' interests. On the contrary, the liberal perspective allows room for IOs to possess a degree of independence and be the cause of action. This study considers these ideas within what it calls the liberal perspective.

The liberal perspective also includes how IOs help states to overcome the problem of collective action and gather an adequate economy of scale for the provision of collective goods, or to gain a comparative advantage for international competition. The European Space Agency is a good example. Collective goods, also called public goods, may involve economic, security, environmental and other matters. The liberal perspective considers "collective security" as another public good which precludes the development of military struggles for power between states. In addition, as discussed

[22] Although both formal and informal institutions have received attention, this study concerns itself only with formal organizations.
[23] Keohane, 1984.
[24] Keohane and Martin, "The Promise of Institutionalist Theory," 42.

above, the term “security” in the liberal perspective is used in a much broader sense than in the realist perspective, and incorporates the concept of “human security.”

The interdependence of states in both the economic and security realms is a key focus of the liberal perspective. Interdependence ideally leads to more cooperation since the mutual costs of confrontation and conflict create an incentive for states to work out their differences peacefully. Likewise, the greater density of interactions helps to reduce misperceptions and helps interests to converge, thus reducing the range of issues which may lead to conflict. Interdependence is also related to Functionalism and Neo-functionalism.[25] Functionalism stresses cooperation in a specific realm of activity across state boundaries between government organizations. Again, the European Space Agency is a great example of such an organization. As state-level functional organizations become more interdependent with counterparts in other states, and succeed in delivering public goods which would not otherwise be provided by the state acting alone, the success they create has “spillover” into other functional areas which leads to resolution of other common problems. The spillover may cascade in unexpected directions and may eventually cut across multiple functional areas from science, technology, and health fields to law enforcement, defense, and economic realms. In addition, neo-functionalist arguments also emphasize how spillover may change participants’ attitudes and identity, making these theories applicable to the ideational perspective as well.[26]

A few final points round out this brief summary of the liberal perspective. First, the liberal perspective places much greater emphasis on institutions, economic

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[25] Ernst B. Haas, *The Uniting of Europe: Political, Social, and Economic Forces, 1950-1957* (Stanford: Stanford University Press, 1958).

[26] Martha Finnemore and Kathryn Sikkink, “International Norm Dynamics and Political Change,” in *Exploration and Contestation in the Study of World Politics,* eds. Peter Katzenstein, Robert O. Keohane, and Stephen D. Krasner (Cambridge: MIT Press, 1999), 265.

cooperation and efficiency than the realist perspective does. Next, the liberal perspective views cooperation which leads to absolute gains favorably. In contrast, the realist perspective views absolute gains suspiciously since they may reduce the differences in relative power between states. Lastly, the liberal perspective gives more significance to diplomacy and negotiation as a way to increase interaction, develop relationships, and avoid conflict.

This study uses these aspects of the liberal perspective in order to derive indicators of the degree to which liberal factors weighed on European decision-makers' assessments of the need for Galileo. In addition, the above summary of the liberal perspective provides the basis for the second hypothesis:

Hypothesis B: Liberal factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.

Liberal indicators: To test Hypothesis B, indicators of the presence of liberal factors are identified below and then sought out in the course of this study. If liberal factors were driving European decision-makers assessments of the need for Galileo this study should find that civil or commercially oriented organizations were deeply involved in initiating and managing the project; that money for Galileo came from civil or commercially oriented sources, and that civil or commercial officials had significant control over the project. In addition this study expects to find actions and expressions of policy that indicate that key European decision-makers stressed that Galileo is most important in relation to cooperation, efficiency, cost effectiveness, economic well-being, comparative

advantage, the provision of public goods, reducing transaction costs, absolute gains, the collective security of the EU, the human security of EU citizens, the environment, the strengthening of institutions, commercial competitiveness, international trade advantages, and as a useful means to build cooperation between the EU and external states, including reference to how Galileo's technological attributes contribute to increased interdependence and enhanced cooperation. Primary sources include: speeches, treaties, policies, conferences, agendas, goals, strategies, decisions, tasks, press releases and other forms of public expression by European leaders and European organizations.

Since the liberal perspective de-emphasizes military considerations and prioritizes institutions, cooperation, mutual gains, efficiency, and economic factors, this study will seek evidence which indicates these priorities were operative including: a relatively high degree of IO responsibility and decision-making power with regard to Galileo; relatively more international cooperation; a high degree of direct or indirect inputs from civil and commercial sources into Galileo's funding, system design requirements, and intellectual frameworks; and lead organizations and actors with purely civilian or commercial competencies and cultures.

If liberal factors weighed more than realist factors, this study also expects to find Galileo funding taking priority over costly European military requirements; European civil and commercial design requirements having a higher priority than military design requirements; no approval or veto power among military and defense actors over Galileo design and operational decisions; and relatively lower levels of spending on physical, information, and personnel security in the Galileo program.

- Actions or expressions of policy which show that key European decision-makers consider Galileo primarily as a means to:
  - improve efficiency, cost effectiveness, economic well-being, comparative advantage, commercial competitiveness of Europe,
  - Provide public goods,
  - Reduce transaction costs,
  - Enhance cooperation within the EU and external to EU,
  - Strengthen interdependence,
  - Bolster the EU's soft power,
  - Bolster the EU institutionally.

- Civil or commercial nature of the organizations initiating or managing the program.
- Civil or commercial nature of the organizations providing funding.
- Civil or commercial nature of the organizations with most control or veto power over Galileo design and operation.
- Civil and commercial requirements having priority over military and defense requirements.
- Absolute gains viewed favorably. Non-zero sum gains viewed favorably.
- Lack of plans to integrate Galileo receivers into armaments.
- Lack of plans to integrate use of Galileo signals into military or security exercises.
- Lack of direct or indirect military inputs into Galileo's organizational structure, organizational culture, and intellectual frameworks.
- Galileo funding taking priority over other EU economic considerations not based upon security or defense arguments.
- Relatively lower levels of spending on physical, information, and personnel security.
- Relatively less protection of technological transfers; tighter export controls.
- More international cooperation.

Figure 4. Liberal Factor Indicators

In sum, indicators which show that cooperation, efficiency, mutual gains, and commercial market considerations were more important than power considerations will indicate that liberal factors weighed more heavily on decision makers assessment of the need for Galileo. While it may not be possible in the course of this study to uncover all the possible indicators noted above, the above list may also serve as a guide for future research.

The Ideational perspective: The fundamental point of the ideational perspective is that "ideas matter" and have a causal effect.[27] This perspective sheds light on important aspects of the Galileo program that would otherwise be missed if we relied solely upon the realist and liberal perspectives.

The ideational perspective incorporates key concepts from the social constructivist perspective which focuses on the ideas that define actors' norms, values, and beliefs.[28] These in turn construct actors' identities and generate their interests and preferences.[29] The social constructivist perspective involves many more aspects that are not necessary to consider for this report such as: how structures and agents are mutually constitutive, the distinction between constitutive and regulative rules, the difference between the logic of consequences and the logic of appropriateness, and the role of communicative action in persuasion and learning.

The ideational perspective also takes in Joseph Nye's concept of "soft power," which is another popular approach to the importance of ideas and identity in international politics.[30] Soft power includes consideration for how cultural attraction and ideology may be leveraged by states and how they have a significant affect on an actor's ability to influence other actors. Placing "ideas" at the hub of the ideational perspective and

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[27] John Gerard Ruggie, "What Makes the World Hang Together? Neo-utilitarianism and the Social Constructivist Challenge," in *Exploration and Contestation in the Study of World Politics*, eds. Peter Katzenstein, Robert O. Keohane, and Stephen D. Krasner (Cambridge, MIT Press, 1999), 227-229.
[28] For a thorough treatment of the definition of norms, and the norm life cycle, including the importance of norm entrepreneurs, norm acceptance, norm internalization and subsequent changes in actors' identity and interests see Martha Finnemore and Kathryn Sikkink, "International Norm Dynamics and Political Change," in *Exploration and Contestation in the Study of World Politics*, eds. Peter Katzenstein, Robert O. Keohane, and Stephen D. Krasner (Cambridge, MIT Press, 1999), 247 – 277.
[29] John Gerard Ruggie, "What Makes the World Hang Together? Neo-utilitarianism and the Social Constructivist Challenge," in *Exploration and Contestation in the Study of World Politics*, eds. Peter Katzenstein, Robert O. Keohane, and Stephen D. Krasner (Cambridge, MIT Press, 1999), 224, 239.
[30] Joseph Nye, "Soft Power," *Foreign Policy* 80 (Autumn 1990): 153-171.

emphasizing "identity" allows this study to consider symbols, ideology, and prestige, which are key aspects of European space efforts.

This study will use these aspects of the ideational perspective in order to derive indicators of the degree to which ideational factors weighed on European decision-makers' assessments of the need for Galileo. In addition, the above summary of the ideational perspective provides the basis for our third hypothesis:

Hypothesis C: Ideational factors weighed the most heavily on European decision-makers' assessments of the need for Galileo

Ideational indicators: To test Hypothesis C indicators of the presence of ideational factors are identified below and will be then sought out in the course of this study. Of course the assessment of ideational factors may easily become entangled with realist ideas about power and liberal notions about cooperation. Therefore, this section sets aside discussion about the influence of realist and liberal ideas on European decision-makers and looks to ideas not enveloped within these other perspectives. Instead, this study will give priority to evidence which indicates that identity considerations, especially ideas about European cohesiveness, pride, and prestige, weighed heavily on European decision-makers' minds in their assessments of the need for Galileo. Likewise, the use of Galileo as a symbol of European dynamism, technological capability, unity, and cultural attraction will be given significant weight. Primary sources include: speeches, treaties, policies, conferences, agendas, goals, strategies, decisions, tasks, press

releases and other forms of public expression by European leaders and European organizations.

Additional indicators that ideational factors weighed on European decision-makers' assessment of the need for Galileo will include: references to ideas – such as ideology, and anti-Americanism; references to identity – such as European, North Atlantic, the international community, a technological leader, and we-they feeling; and concern for norms – such as the peaceful use of outer space, civilian control of public goods, and international management of global public goods and global commons issues.

In addition, cooperation based more on shared identity and ideas held in common rather than on power or economic efficiency considerations will indicate the relative weight of ideational factors. Likewise, decisions which show that ideas overrode concerns about such liberal and realist focuses as cooperation and cost effectiveness, or the military utility of Galileo and power balancing, respectively, will indicate that ideas mattered most.

- Actions or expressions of policy which show that key European decision-makers consider Galileo primarily as a symbol of European dynamism, technological capability, unity, and cultural attraction and as a means to:
  - Facilitate the strengthening of the "European identity" by bolstering European pride, prestige, and cohesiveness.
  - Bolster the EU's soft power.

- Actions or expressions of policy with priority given to:
  - Ideas, such as anti-Americanism.
  - Identity, such as European, Western, North Atlantic, or a we-they feeling.
  - Norms, such as peaceful uses of outer space, civil control of public goods, *juste retour*.

Figure 5. Ideational Factor Indicators

The complex mix of actors involved in the Galileo project and the multi-use nature of Galileo obscures whether realist, liberal or ideational factors were relatively more important in European decision-makers' assessments of the need for Galileo. The approach outlined above will help provide a more clear answer, but for a more thorough understanding of what was driving the Galileo project it is also useful to consider which level of analysis was relatively the most significant.

4. Levels of Analysis: This study considers four levels of analysis in order to understand as comprehensively as possible the many factors which influenced European decision-makers assessments of the need for Galileo, including the levels relationship to each other, and their patterns of interaction.[31] The "international level" (or system level) treats the EU "as if" it is a rational state actor and focuses on Europe's relationship with the world beyond Europe, particularly the relationship the United States.[32] The "European level" considers the interests of European institutions and their interaction with key member states. The European institutions considered are the EC Transportation Directorate General, Pillar Two of the EU, and ESA. The "national level" considers the interests of the key European states involved in the Galileo project, namely France, Germany, Italy and the United Kingdom. The "industrial level" considers the interests of the prime contractors from the "upstream" portion of the European space industry (satellite manufacturers, launcher manufacturers, and launch service providers). In order

[31] J. David Singer, "The Level-of-Analysis Problem in International Relations," in *The International System,* eds. Klaus Knorr and Sidney Verba (Princeton: Princeton University Press, 1961), 77-92.
[32] The reader must be careful not to confuse levels of space activity in Europe with the international, European, national, and industrial levels of analysis used in this study. Therefore when referring to space levels of analysis, a hyphen will be used, as in the "European-level of space activity." No hyphen will be used when referring to the levels of analysis.

to limit the scope of this assessment, consideration of small and medium size enterprises, subcontractors, and the downstream service industry is set aside. That said, the European space industry is analogous to the sub-national, interest group level when sovereign states are under examination. Complicating the picture significantly, the European aerospace industry prime contractors consolidated first at the national-level and then at the European-level during the years included in this study. In effect, the prime contractors changed over the course of this study from being many sub-national actors into being primarily two European-level actors. The consolidation created a much greater economy of scale and comparative advantage for the European space industry which gave them the ability to compete and survive in the global market and provided them a commensurate greater amount of political and economic clout. As of 2007, the two biggest actors in the European space sector were EADS-Astrium and Thales-Alenia. They operate across the European-level, the IGO-level and the national level of the European space sector. They also operate among the civil space, commercial space, and security space sectors.

5. Decision-makers: This study will not investigate what motivated the Galileo program at the individual level. It will not try to determine precisely which individuals had the most influence and does not attempt to determine the personal interests and personalities of the decision-makers involved in the decisions under examination. Rather, it will take a high-level view to evaluate how realist, liberal and ideational factors weighed in European decision-makers' assessments of the need for Galileo. As noted above, the study looks to these decision-makers' public expressions of policy and behavior.

Therefore, this section briefly identifies the positions of the key decision-makers at each level but does not necessarily delve into individual names.

The Galileo program's key European decision-makers include the European Council (Heads of State and Governments) and the Council of the European Union - in particular the Transport Council, the Research Council, and the Council of Foreign Ministers. Whenever one of these Councils officially promulgates a decision, it indicates that the decision reflects its collective will. Therefore, any official communication from the Council reflects its view on matters. In addition, the decisions of the Secretary General and High Representative for the Common Foreign and Security Policy also reflects the Council's desires.

In the European Commission, the EC Vice President and Commissioner for Transport (the same person) and the Director General for the Energy and Transport Directorate are key players. Similarly, the EC Vice President and Commissioner for the Enterprise and Industry Directorate General as well as Director General for the Research Directorate are key decision-makers whose official policy statements firmly indicate the EC's position.

At ESA, the Director General has significant autonomy to set policy and prioritize activities. However, the ESA Council at Ministerial-level has power over ESA's budget, and approves ESA programs. The ESA Council at Ministerial-level, as mentioned in Chapter 2, is comprised of the Research Ministers (or the equivalent minister in charge of space) from each ESA Member State.

At the national level, the Galileo program's key decision-makers actually include many of the same individuals that participate as decision-makers in the EU and ESA.

Heads of States and Governments, Transport Ministers, Research Ministers, Foreign Ministers, and Defense Ministers are the national level decision-makers examined in this study. Of course, national Parliaments approve national budgets which affect the amount of funding available for space activities, but this study only considers “Executive branch” decision-makers, and considers parliamentary influence as outside the scope of this report. These are the decision-makers which decide the course of the Galileo program and which are considered for this study.

The approach described above will help explain Galileo’s ability to survive by addressing two basic research questions: 1) Did realist factors, liberal factors, or ideational factors weigh the most heavily on European decision-makers’ assessments of the need for Galileo and 2) Are European decision-makers’ assessments of the need for Galileo being driven more by the international, European, national or industrial levels?

I do not expect to arrive at a definitive conclusion but I hope to contribute to the understanding of the Galileo program’s ability to survive. Such insight may help us to better understand Galileo’s past and anticipate Galileo’s future course.

Part II: Dead Reckoning[1]

Chapter Four:
Setting Out

Chapter Four takes this investigation up to the first decision point, the 1999 EU decision to pursue an independent navigation satellite capability and the approval of the "Definition Phase" of the Galileo project.

The evidence uncovered in this chapter supports **Hypothesis B: Liberal factors weighed the most heavily on European decision-makers' assessments of the need for Galileo in 1999.** It is reasonable to argue that the deeply embedded civil and economic nature of EC, and the equally deep civil and "peaceful" purposes of ESA, along with the lack of interest in Galileo among European militaries, the non-military sources of funding, and the lack of defense or military control over the project, makes it doubtful that realist factors weighed heavily. Furthermore, the 1990s saw the decline of "prestige" as a motive for space activities and the rise of commercialization, competition, and global market opportunities as the new drivers for space projects. Utilitarian arguments for new space projects dominated, with cost effectiveness being a far higher priority than pride and prestige. The desire for greater European autonomy was also a factor but due to the argument that "autonomy" is not a very useful term in the approach used here, I did not give the desire for autonomy significant weight as a realist factor. In addition, the evidence shows that the international level was the most significant influence on the decision to initiate Galileo.

[1] "Dead reckoning" allows a navigator to determine the present position by projecting from a known past position.

1. Overview:

A number of significant trends converged in May and June 1999 when European ministers in charge of space at ESA and European Transport Ministers at the EU decided to approve Galileo's "Definition Phase." Exploring the development of these trends reveals indicators which help us to weigh the various factors behind the decision. The trends described below include the development of satellite navigation as a critical global utility and the growing recognition of its economic and military importance. Other major trends include the European Union's evolution during the 1990s including the development of the Common Foreign and Security Policy (CFSP) and the European Security and Defense Policy (ESDP), the EU's failure to provide security in the Balkans, and the EU's growing interest in space applications as tools for helping it achieve its economic and security goals. In addition, the global aerospace industry experienced major transformations in the 1990s causing concern among European leaders about the future ability of Europe's industry to compete and survive in the new global commercial aerospace market. The rise of Public Private Partnerships (PPPs) as a funding tool took root in this environment. At the same time, European decision-makers increasingly recognized that ESA, by itself, was not capable of meeting Europe's need for space applications, in part due to ESA's lack of political power. In addition, Europe's frustration over repeatedly failing to benefit significantly from cooperation on space projects with the United States also reached new levels. Political, economic, and security trends in France, Germany, Italy, and the United Kingdom were also factors.

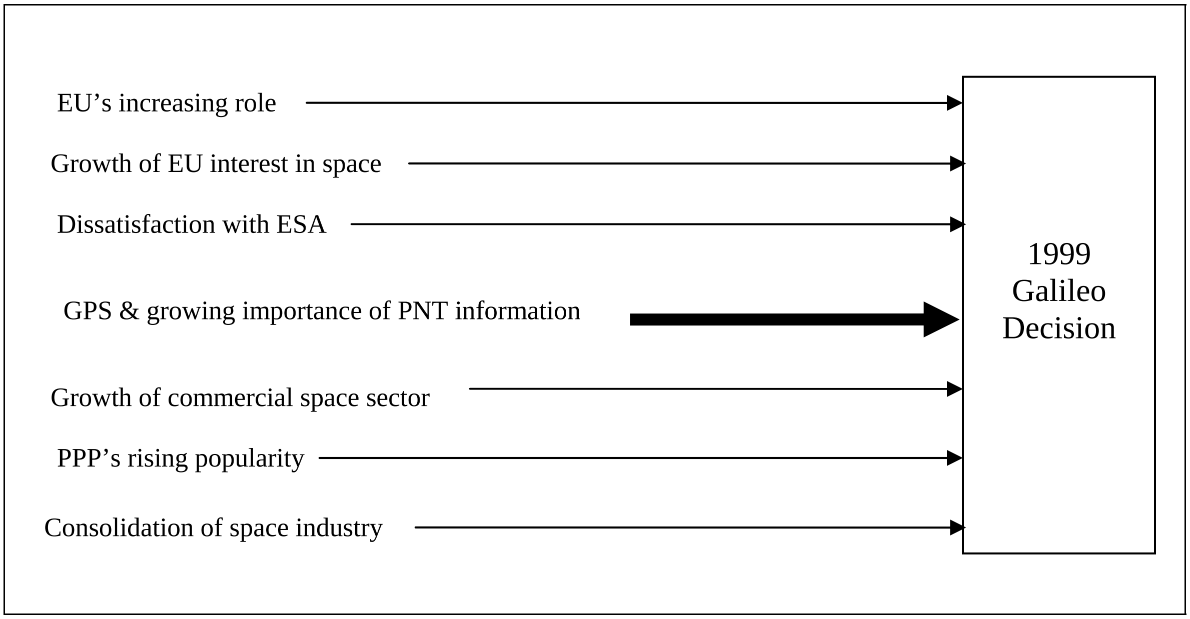

Figure 6. Major Trends

These trends converged in the late 1990s and their influence can be seen in the European Commission's 10 February 1999 Communication entitled "Galileo: Involving Europe in a New Generation of Satellite Navigation Services." The sections below chronicle the development of these trends.

2. The development of satellite navigation and its growing importance.

This section describes chronologically the American and European efforts to develop satellite navigation capabilities; how GPS became indispensable in the 1990s for military, civil and economic purposes; and how Galileo was a reaction to these new circumstances. The analysis shows that while the United States and USSR satellite navigation programs were always primarily military projects, clearly indicating their realist drivers, the

collective European efforts to develop satellite navigation for civilian applications beginning in the 1960s were based more heavily upon liberal drivers.[2]

The notion of using satellites as navigation aids originated at the dawn of the space age. In fact, the fundamental technical ideas behind the U.S. Navy's Transit navigation satellites were established within days after the launch of Sputnik in 1957. By 1964, the Transit system was the world's first operational satellite navigation system and consisted of seven satellites in low altitude, polar orbit.[3] However, Transit had some significant limitations.[4] For example, due to Transit satellites' low altitude orbits and the small number of Transit satellites, their navigation signals were often not available for large periods of time over wide areas. Nevertheless, Transit was an important piece of the U.S. strategic nuclear deterrent and clearly represented an advanced military capability.

Transit also foreshadowed some of the dual-use issues which became more prominent with GPS in the 1990s and which are a constant cause of controversy for Galileo today. In 1967 President Johnson allowed Transit navigation data to be made globally available for commercial shipping and aviation for all nations. This step signaled the international nature of satellite navigation. Transit's navigation signals

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[2] The former Soviet Union developed the GLONASS satellite navigation system which Russia operates and maintains today. It is much less capable than GPS for a variety of political, economic and technical reasons. In-depth consideration of GLONASS is beyond the scope of this study.

[3] Pace et al, *The Global Positioning System*.

[4] In 1964, the U.S. Navy began work on a second satellite navigation program called "Timation." and launched the first "Timation" satellite in 1967. The technology that Timation proved made such an important contribution to GPS that the last two "Timation" satellites were used as proto-type GPS satellites. In 1963, the U.S. Air Force requested the Aerospace Corporation to continue studies into how aircraft in flight could benefit from satellite navigation. These studies led to Air Force System 621B which successfully demonstrated its technology by 1972 and also contributed significantly to the technology used in GPS. Meanwhile, by the late 1960s, the U.S. Army proposed its own satellite navigation system called, SECOR (Sequential Correlation of Range). These three independent programs were merged in a Joint Program Office in April 1973, the U.S. Air Force was made the lead agency, and the NAVSTAR GPS program concept emerged. In December 1973, DoD approved the first phase of the three phase development of GPS. Pace et al,. *The Global Positioning System*, 239-241.

provided a common good, i.e. a useful navigation aid, available over large bodies of water where few other navigation aids existed. Accurate navigational aids are important for the maritime industry and are particularly important for the aviation community due to the speed at which aircraft fly. In such a high speed environment, small navigation errors have the potential to rapidly develop into large errors. Accurate navigation results in the more efficient use of airspace, fuel, and time. By the 1970s, even with Transit's limitations, the value added by Transit resulted in the commercial uses of Transit exceeding its military uses. Even so, by 1980 there were only about 10,000 users of the Transit system.[5] Transit was built primarily as a military capability but its dual-uses show us that the GPS and Galileo dual-use issues of today can trace their roots to similar matters that first arose nearly 40 years ago.

Meanwhile, in the early 1960s, European governments realized that no European country could have a comprehensive space program on its own. The high cost and high technology required to access space and benefit from space meant that European states needed to combine efforts.[6] European efforts to organize cooperative European space activities have been described in numerous studies; so have European efforts to develop a comprehensive array of space capabilities, especially an autonomous launch vehicle and communication satellites. Therefore, this study concentrates here on briefly tracing the roots of the European effort to develop a European civil navigation satellite system. That effort takes this study almost all the way back to the beginning of the European space effort.

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[5] K.F. Walker, B.A. Ambrosius, H. Leeman et al, "Navigation and Orbital Computation Aspects of the ESA NAVSAT System Concept," ACTA *Aerospace* 15, no 4, (1987): 195.
[6] Bildt and Dillon, "Europe's Final Frontier," 8.

Europe recognized the value of satellite navigation early in the space age. France, the leader in European space efforts as noted in Chapter Two, was already developing a twin set of navigation satellites to assist with air traffic control in 1967.[7] At the European level, the December 1967 *Causse Report* to the European Space Council (ESC), "Report of the Advisory Committee on Programmes," concerning the development of future European space activities, noted the usefulness of navigation satellites in assisting aeronautical navigation. The report stated that air traffic control, especially over the North Atlantic, was a "public service activity" and that an "aeronautical satellite" would improve air traffic safety and produce significant commercial airline savings.[8] This shows that Europe was contemplating a civil satellite navigation and communication system, for liberal reasons, at a very early stage.

The *Causse Report* was significant in other ways as well. Its purpose was to propose a comprehensive plan for the European space sector, which at the time was fragmented and ineffective due to competing national level priorities and ineffective governance at the European Launch Development Organization (ELDO) and European Space Research Organization (ESRO).[9] The report states that Europe did not have the resources to develop a sizeable independent space program. Cooperation with outside space powers was necessary. However, the lack of independent European space capabilities would perpetually relegate Europe to a secondary, junior partner role in cooperative space projects and the goal of using such projects to help develop European

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[7] Krige and Russo, "A History of the European Space Agency 1958-1987," 340.
[8] Ibid.
[9] It is not the intention of this study to discuss the details of the evolution of ESA prior to the 1990s: significant details include how ESA's organizational roots began in the European Launch Development Organization (ELDO) and the European Space Research Organization (ESRO), and how those organizations were inadequate to the task of creating successful European space cooperation. Details also involve various ELDO and ESRO reports, meetings, and decisions, such as the Causse Report, which are now part of ESA's history.

technology would not be achieved. Therefore, the report advised that in order for Europe to become a respected and essential partner in cooperative projects with other space powers, particularly the United States, and in order to share in the full benefits of space activities, Europe should try to achieve independent capabilities in launchers and in application and scientific satellites. Independent capabilities would strengthen Europe's position in collaborative programs and were, therefore, considered prerequisites for getting the most benefit from partnership projects.[10] The *Causse report* influenced European decision-makers' thinking about European space policy.[11] The European desire to be treated as an equal partner with independent space capabilities as a prerequisite can be seen in the Galileo program today.

In July 1968, a joint European and American civil air traffic control satellite program was discussed for the first time. The discussion occurred on the margins of European negotiations with the United States on launchers and satellite telecommunication systems. The project was considered to have "excellent possibilities."[12] The benefits of the program for Europe were noted as: increased air navigation safety and efficiency, a chance to develop expertise in telecommunication technology, and an opportunity to cooperate with the United States.[13] In November 1968, at the ESC Bad Godesberg Conference, $1 million was committed for ESRO to conduct a

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[10] Madders, *A New Force at a New Frontier*, 127.
[11] Ibid
[12] Krige and Russo, "A History of the European Space Agency 1958-1987," 392. Krige and Russo refer to Aerosat as providing both communication and navigation services. However, Krige and Russo are ambiguous as to which one of these services was primary.
[13] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 100. Suzuki description of the Aerosat satellite system focuses almost exclusively on the navigation signals it would provide and only mentions its planned communication services in passing. However, both Suzuki, and Krige and Russo strongly link the demise of Aerosat with the development of GPS, inferring that Aerosat was primarily being developed to provide navigation services.

study on the potential for European meteorological and "air navigation" satellites.[14] In 1969 NASA and the U.S Department of Transportation (DOT) engaged in official contacts with ESRO regarding cooperation on air navigation satellites. Momentum continued to slowly build and in June 1970 another important report on European space activities, the *Puppi Report*, also endorsed the air navigation satellite project. Studies on the air navigation satellite project were completed and the project was named "Aerosat." Numerous other countries were also interested in the project. In June 1971 when the first exploratory meeting on cooperation in an air traffic control satellite program took place it included the United States, nine European countries, Australia, Canada, Japan, and the Philippines.[15] Obviously, many nations perceived a need for civilian navigation satellites.

Soon after, at the July 1971 ESRO Council, France, Germany, Britain, and Italy agreed to begin studies for meteorological, navigation, and telecommunication satellite programs and agreed to pay contributions according to their proportion of GNP.[16] Regarding the Aerosat program, the Europeans were explicit that they would not accept a role in the Aerosat program as merely subscribers to services provide by a system unilaterally established by the United States. Since Europe now had guaranteed financial support lined up, if they could not attain equal partner status they were prepared to proceed on Aerosat without the United States.[17] This statement apparently grew out of European aggravation over difficulties with the United States involving other, bigger, collaborative space projects. Already by 1969, Europe was growing frustrated over the

[14] Madders, *A New Force at a New Frontier*, 137.
[15] Krige and Russo, "A History of the European Space Agency 1958-1987," 411.
[16] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 76.
[17] Krige and Russo, "A History of the European Space Agency 1958-1987," 411.

limitations on cooperation imposed by the United States.[18] It is beyond the scope of this study to trace the detailed history of European and American space cooperation and Europe's growing dissatisfaction with U.S. policies, including American refusal to provide launch services for European commercial telecommunication satellite projects, the lack of U.S. support for an autonomous launcher capability, Spacelab's expense and poor return on investment for Europe, and Europe's lack of return on investment for its participation in the International Space Station, except to note that Europe was already becoming wary of collaborating with the United States by the time the Aerosat project began in the early 1970s.

In August 1971 ESRO signed a Memorandum of Understanding (MOU) with the U.S. Federal Aviation Administration to develop two out of four Aerosat satellites and to share launch and operating costs.[19] The satellites were to be jointly owned by the United States and Europe (as a single entity). An Aerosat Council in which the United States had one vote, and the Europeans (again as one entity) had one vote, was to be established to manage the program. However, the White House never approved the MOU and negotiations had to start again in 1972.[20] Momentum slowed down again but in the meantime the International Civil Aviation Organization (ICAO) also weighed in favor of an experimental civil navigation satellite system. Finally, on August 2, 1974 a new MOU for the development of Aerosat was signed between the FAA, ESRO, and the Canadian Government. By 1976, bids were received for the program's development and launches were expected to begin in 1978.

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[18] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 72.
[19] Ibid., 100.
[20] I was not able to determine why the White House did not approve of the MOU.

Two obstacles arose, however, which the Aerosat program was unable to overcome. First, in December 1973, the U.S. Department of Defense (DoD) approved the development of the new U.S. military navigation satellite system, the Navstar Global Positioning System (GPS), discussed previously.[21] GPS was based on different technology and different system concepts than Transit and Aerosat which made it much more accurate, capable of providing positioning information in three dimensions, as well as velocity and time transfer information, and capable of being continuously available to military and commercial users around the globe.[22] Second, airlines and civil aviation control officials began to question the usefulness and cost effectiveness of the Aerosat program and even which frequencies to use. These opponents to Aerosat lobbied the U.S. Congress against funding Aerosat.[23] The combined result was that in 1977 Congress killed the program and the United States turned its full attention to developing the military's GPS system without Europe. Europe went on for another year before abandoning Aerosat in 1978, the same year the United States began testing GPS satellites on-orbit.[24] Ten years of Aerosat negotiations and planning had led to nothing for Europe. The complex interplay between European ambitions for a civil navigation (and communication) satellite system and GPS had begun.

This brief history of the Aerosat program shows us that Europe was willing to commit considerable energy and resources to the development of a civil navigation satellite system as a public good to be managed by an international organization in order to improve the efficiency of air traffic, a major component of the European transportation

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[21] Pace et al., *The Global Positioning System*, 241.
[22] GPS signals can be blocked by buildings, and reception in polar areas degrades.
[23] Madders, *A New Force at a New Frontier,* 451.
[24] Madders, *A New Force at a New Frontier,* 451. And Pace et al., *The Global Positioning System*, 242.

infrastructure. International cooperation beyond Europe was preferred, especially with the United States, but European decision-makers made it clear that Europe must be considered an equal partner in the project. These Aerosat program characteristics were to be reflected in the later Galileo program.

The European Space Agency[25] kept the flame for a civil air navigation satellite system alive in Europe during the 1980s. In 1982 ESA began a series of studies which resulted in the definition of a navigation satellite system called NAVSAT.[26] NAVSAT was billed as a civil variant of GPS - just as Galileo was later described. The NAVSAT studies, along with CNES system studies, led to the development of satellite navigation transponder technology used in EGNOS.[27] In addition, the NAVSAT program merged with the separate but similar West German satellite navigation project called the Global Radio Navigation Satellite, or "GRANAS."[28] Finally, the NAVSAT program included a vision for the evolution and development of the European component of a civil, global navigation satellite system which was reflected in later planning for the GNSS-1 and the GNSS-2 programs.

The efforts ESA put into NAVSAT in the 1980s carried over to EGNOS and Galileo in a number of ways. First, as envisioned in the first operational stage of the NAVSAT program, NAVSAT would augment the navigation services provided by GPS

[25] As noted earlier, ESA replaced ELDO and ESRO in 1975.
[26] In 1982, there was already an ESA study on the User Segment of Navsat. Wilson, ed., "Galileo Programme," 19.
[27] Karin Barbance and Karl Bergquist, "Satellite Navigation Activities: The International Context," *Space Communications* 14 (1996), 155-161. http://web.ebscohost.com.proxygw.wrlc.org/ehost/detail?vid=2&hid=101&sid=0f261fa9-52. (accessed January 7, 2008).
[28] Dr G, Ploeger, "A Fully Integrated CNS Satellite Network Proposed," *ICAO Bulletin*, March 1988, 12. http://www.icao.int/icao/en/jr/1988/4303.djvu (accessed October 27, 2007). Jefferey M. Lenorovitz, "ESA NAVSAT Concept as New Civilian Navigation System," *Aviation Week & Space Technology*, January 25, 1988, 54.

and GLONASS in a specific geographical area, i.e. over Europe and the North Atlantic, using a limited number of satellites. Today EGNOS demonstrates this NAVSAT concept. Second, in the second operational stage of the NAVSAT program, NAVSAT would be an independent, civilian global navigation satellite system, which would not rely upon GPS or GLONASS. Today, the Galileo program reflects the fruition of this part of the NAVSAT concept. The NAVSAT satellite navigation system concept was very similar to what later became the Galileo system architecture, envisioning 24 satellites encircling the globe at 12,500 miles altitude circular orbits and inclined at 55 degrees to the equator.[29] Third, the NAVSAT system was planned to have the capability to notify users in real-time about the quality of the navigation signal, which the aviation community identified as a key requirement, and which is a capability GPS and GLONASS lack. Today, this capability is advertised as an important Galileo capability. Finally, and perhaps most significantly, NAVSAT was conceived with primarily civil aircraft navigation in mind even though NAVSAT's multi-use capabilities were recognized and included in the program's definition.[30]

Galileo's roots can be connected to the NAVSAT effort in other ways as well. In 1988, one European airline executive is reported to have said, "For airlines, the whole idea of satellite navigation is to improve our navigation accuracy and safety while reducing the amount of on-board and ground-based equipment required to do it. What worries us about relying on a system such as GPS is the fact that it is a military system, and there is no guarantee that the U.S. military won't restrict our access to it in time of crisis or someday say they no longer need such a system. Something like this already is

[29] Walker and others, "Navigation and Orbital Computation Aspects." 195. In addition, a proposal based upon satellites in highly inclined elliptical orbits was also given strong consideration.
[30] Lenorovitz, "ESA NAVSAT concept as new Civilian Navigation System," 54.

happening with the U.S. Navy's Transit satellite navigation system – which will be abandoned in the 1990s because they won't have use for it any longer."[31] European supporters of NAVSAT considered its independent, civilian aspects as its strong points. The NAVSAT program demonstrated that many of the European concerns about GPS, and many of the arguments in favor of Galileo, as well as many of the major technological concepts behind Galileo, were established well before the 1990s, and thus the end of the Cold War, and before the post-Cold War discussion of the need to "balance" American uni-polar power became part of the discourse on Galileo.

Meanwhile, during the 1980s GPS satellites were slowly being deployed and their utilization gradually increased. Between 1978 and 1985 eleven GPS Block I satellites were launched. In addition, by 1978 ten NATO nations were participating in the development and testing of GPS applications for NATO and in 1992 NATO chose GPS as its PNT provider. In 1993 the United States provided access to the GPS encrypted PPS signal to NATO allies.[32] But it was not all smooth sailing. In 1979, the GPS budget was cut 30 per cent for the 1981-1986 timeframe resulting in program reductions and pushing achievement of initial operational capability well into the late 1980s. In addition, GPS was a joint military program involving the U.S. Army, Navy, and Air Force, with the result that none of the military services were eager to bear the majority of program costs. Since GPS is considered a "support system," it did not compete well for funding against "weapon systems," such as tanks and aircraft and other better understood military capabilities. At the time there was such little understanding of the tremendous future potential of GPS that the program was zeroed out in the Air Force budgets in 1980,

[31] Ibid.
[32] European Commission, *State of the Galileo Programme*, COM (2002) 518, (Brussels, EC, September 24, 2002), 22. And Beidleman, "GPS vs Galileo," 139.

1981, and 1982. The Air Force was not agreeable to paying for a support system for which the Air Force would not be the primary user. However, the Office of the Secretary of Defense (OSD) reinstated the funds in the budget in each of those years, enabling GPS to survive.[33]

In reaction to the 1 September 1983 Soviet shoot down of a Korean Airlines commercial flight which had strayed into Soviet airspace, President Reagan announced that the United States would make GPS signals available to civilian aircraft as soon as the system became operational, which was expected to be in 1988.[34] As noted above, Transit signals had been available to commercial users since 1967, so the decision to make military satellite navigation signals available to commercial users was already set in precedent. However, no one anticipated the degree to which civil and commercial users would adopt GPS technology and become dependent on it.[35]

GPS experienced another set back with the 1986 Space Shuttle *Challenger* tragedy. The space shuttle was the only planned launch vehicle for GPS, so the *Challenger* disaster caused the launch of GPS Block II satellites to be delayed two years.[36] Nevertheless, although the system was not declared operational in the 1980s, in 1987 the DoD and the DoT began working together on issues concerning the civilian uses of GPS.

GPS had a minor role in military operations in the 1980s and its commercial uses, while promising, were not very significant. GPS helped the U.S. Navy keep track of

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[33] Scott Pace et al., *The Global Positioning System*, 241.
[34] White House, Office of the Press Secretary, "Statement by the Principal Deputy Press Secretary To The President," September 16, 1983.
[35] James Vedda, "Space Commerce," in *Space Politics and Policy*, ed. Eligar Sadeh (Dordrecht, The Netherlands: Kluwer Academic Publishers, 2002), 208.
[36] The first GPS Block II satellite eventually was launched in February 1989

Persian Gulf minefields in the 1987-1988 time period and the U.S. Air Force used GPS in limited ways during the hostilities in Panama in 1989.[37] On the commercial side, GPS found its first market in surveying. Though small, the surveying market's successful use of GPS spurred further research and development into commercial GPS applications which led to improved GPS civilian receivers and the production of a significant number of them. In addition, these users developed the initial concepts and techniques upon which "Differential GPS" (described in Chapter Two) is based.[38] In sum, in the 1980s GPS faced many hurdles and its future military and economic value was under appreciated.

When the Cold War ended, the strategic competition between the United States and the Soviet Union was finished in space as well as elsewhere. This was the period when GPS burst onto the international scene as the revolutionary technological capability that helped the United States and its coalition rout the Iraqi army in the 1991 Persian Gulf War.[39] Its new found tactical military importance was so unexpected that U.S. forces were not adequately supplied with military GPS receivers. On average, U.S. ground forces had "at least one" GPS receiver per maneuver company, which was clearly inadequate.[40] In response more than thirteen thousand commercial receivers were rushed to the field and attached, sometimes with tape, to vehicles, helicopter, and combat aircraft instrument panels. In the end close to 90 percent of the GPS receivers fielded in the conflict were commercial receivers. Selective Availability was turned off so that soldiers using commercial receivers had the most accurate signals possible. In an interesting twist

[37] Pace et al., *The Global Positioning System*, 251.
[38] Ibid., 241.
[39] Ibid.
[40] Pace et al., *The Global Positioning System*, 245.

the commercial surveying market of the 1980s and the resulting supply of commercial GPS receivers enabled the commercial sector to meet the sudden unexpected demand from the military for a large number of GPS receivers. Then, in turn, GPS's celebrity status due to its success in the Gulf War created a surge in commercial demand for GPS receivers.

A major new market almost literally dropped out of the sky. Hereafter, the popularity of using GPS for military, civil and commercial services took off and as it became embedded more and more into all levels of society during the 1990s, its military, economic, and political importance mushroomed. Air traffic management become just one of many applications that made use of navigation satellite signals, and the aviation community went from being the primary group interested in civil satellite navigation to one among many interest groups.

Nevertheless, in 1991 the aviation community was still the primary interest group and it began to push harder for a gradual transition from conventional land-based navigation systems to global navigation satellite systems. Increasingly crowded airspace, increasing inefficiency in the air traffic system, and growing costs for maintenance and the operation of the ground-based air traffic control infrastructure drove the desire for a GNSS.[41]

Six months after the Persian Gulf War, at the September 1991 International Civil Aviation Organization's Tenth Air Navigation Conference, the Communication, Navigation, and Surveillance/Air Traffic Management (CNS/ATM) concept was proposed. The proposal was very similar to the NAVSAT concepts discussed above with

[41] The operation cost of ground-based aeronautical radio-navigation systems in Europe alone were estimated to be 100 million ECU per year. Commission, "Global Navigation Satellite System - High Level Group."

the first phase, GNSS-1, being based on augmented GPS signals in order to alleviate some of the reliability and monitoring concerns noted above. With GPS augmentation, commercial aviation would then be able to take full advantage of GPS. The ICAO proposal was for GNSS-1 to become operational around 2005. The concept's second phase, GNSS-2, called for an independent civilian, global navigation satellite system becoming operational around 2010.[42] Considering that this proposal was made in 1991, the original timelines established later for EGNOS and Galileo meld with this ICAO proposal quite closely.

However, during this ICAO conference the United States offered GPS as the low cost alternative to GNSS-2. On 5 September 1991, the United States announced that GPS Standard Positioning Service (SPS) signals (the less accurate signals) would be made globally available, free of charge to all users, beginning in 1993. This was consistent with U.S. Transit navigation satellite policy and was consistent with the announcement President Reagan had made back in September 1983 regarding the use of GPS for civilian purposes.[43] Note that in 1991 the commercial power of GPS and its importance as a public good were just barely beginning to come to light, so it is difficult to argue forcefully that the United States was making this offer in order to undermine European commercial ambitions or to weaken European autonomy. Nevertheless, the complex interplay between GPS and an autonomous European civil global navigation system continued.

A year later at the September 1992 ICAO Assembly, the United States repeated its intent to make GPS SPS signals globally available and free of charge by 1993 and

[42] Lembke, *The Politics of Galileo,* 5.
[43] SPS signals are accurate to within about 100 meters.

added that the United States would give six years notice prior to program termination or elimination of GPS.[44] But many countries were still not comfortable with the idea of relying on a unilaterally owned military system such as GPS which would subject system users to the whims of the U.S. military or shifting U.S. priorities. There were also legitimate performance, reliability, and legal liability questions about GPS and the United States simply could not guarantee the integrity, availability, and continuity of the system since GPS is first and foremost a military system. For decision-makers responsible for managing a safe, efficient, and reliable global air traffic management systems these were crucial issues. An independent, civil GNSS was considered the best solution. These attitudes were consistent with European concerns stretching back to the 1960s, as shown in the discussion above on the history of the Aerosat program.

In October 1993, the U.S. DoD signed a Memorandum of Understanding with NATO member countries allowing them access to the PPS/encrypted navigation signal.[45] Then in December 1993 at the same time that GPS officially reached initial operating capability,[46] the United States took a step to alleviate international concerns about the U.S. DoD being solely responsible for the management and operation of GPS.[47] DoD and DoT had been cooperating on the policy aspects of the civil uses of GPS since 1987 but final decision authority remained with the DoD. The Joint DoD/DoT Task Force was established earlier in 1993 to consider the implications of increased civil and commercial use of GPS, and to evaluate GPS's shortcomings from a civil perspective. Its December

[44] Pace et al., *The Global Positioning System*, 248.
[45] European Commission, *State of the Galileo Programme*, 22.
[46] Initial operating capability is a program management term which means that a system is capable of providing the services it is designed to deliver, but the full testing and evaluation regime required contractually may not be completed. In addition, contractually required spares, documentation and support services and so forth may not have been delivered.
[47] Pace et al., *The Global Positioning System*, 246.

1993 report recommended that the GPS management structure be revamped to include civilian participation in GPS policy and management.[48] This eventually led to the creation of the permanent Interagency GPS Executive Board in March 1996. Meanwhile, in 1993 the FAA approved GPS as a supplemental navigation aid for en route phases of flight and non-precision approaches, and ICAO approved the use of GPS and GLONASS as interim GNSS systems.

Also in late 1993 the European Space Agency placed its satellite navigation related activities in the framework of its Advanced Research in Telecommunication Systems, Element Nine (ARTES 9) program.[49] The broader ARTES program was significant because it demonstrated that ESA was capable of adapting its research and development activities into a PPP framework.[50] (PPPs are described in more detail in a separate section below.) ARTES 9 also provided the basis for ESA's involvement in the European Tri-partite Group, also described below.

By March 1994 when the GPS constellation was completed with the launch of the 24th GPS Block II satellite, the military, civil, and commercial significance of GPS was well understood and European Transport Ministers realized they needed to respond or else accept that Europe's air traffic control system as well as its broader transportation infrastructure would be dependent on the U.S. military controlled GPS system. Europe was being left behind.

In May 1994 the EC released a report, "Europe and the Global Information Society: Recommendations to the European Council," known as the Bangemann Report.

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[48] Pace et al., *The Global Positioning System*, 252.
[49] Barbance and Bergquist, "Satellite Navigation Activities,"155-161. ARTES-9 program was not officially approved until December 1994.
[50] Madders, *A New Force at a New Frontier*, 580.

This report made five significant observations. It noted that satellites were relevant building blocks for Europe in the global information society. It also recognized that the EU's satellite policy needed to be couched in the context of Trans-European Networks (TENs), which include transportation, telecommunication, and energy networks in the European Union.[51] In addition, it emphasized that European industry should participate in the development of global information systems and that private sector funding should be used in order to fulfill this objective.[52] The European Council endorsed the Bangemann report on 24 June 1994.

Also in June 1994, European Transport Ministers[53] at the European Civil Aviation Conference (ECAC) directed ECAC Member States, the European Commission (DG TREN), ESA, and EUROCONTROL to coordinate a European contribution to GNSS-1 and GNSS-2.[54] An earlier EC report "Satellite Navigation Issues: A European Approach," had proposed such an approach.[55] Thereafter, DG TREN at the European Commission took the lead in managing formal cooperation among these organizations. They formed the so-called "European Tri-partite Group" (ETG) with the purpose of implementing a European contribution to GNSS.[56]

Soon thereafter, on 19 December 1994, the European Council approved a resolution on the European contribution to the development of a civil GNSS. This

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[51] P. Hartl and M. Wlaka, "The European Contribution to a Global Civil Navigation Satellite System." *Space Policy*, 12 (1996): 171.
[52] Madders, *A New Force at a New Frontier*, 546.
[53] ECAC had 36 Member Sates in 1994, including all the Members States of the EU and ESA. Thus, the Transport Ministers representing their Member States at ECAC are the very same Transport Ministers representing their Member States at the EU Transport Council. This gives them political authority in both institutions.
[54] Lembke, *The Politics of Galileo*, 6.
[55] William Johnson, "GPS and GNSS: An Updated Report," *Satellite Communications* 19, no. 6 (June, 1995): 46.
[56] Barbance and Bergquist, "Satellite Navigation Activities," 155-161.

marked the first official recognition at the highest political level in Europe of the significance of satellite navigation for Europe. (The EU's growing role in space issues over the course of the 1980s and 1990s is described in more detail in a separate section below). It recognized the need for Europe to play a key role in the implementation of a civil GNSS and recommended a two step approach: first develop EGNOS as a GNSS-1 system and then develop a European contribution to a civil, global navigation satellite system, that is, GNSS-2.[57] Note how consistent this Council recommendation appears to be with ESA's 1980's vision for NAVSAT and the 1991 ICAO CNS/ATM concept mentioned above.

Up until this time Europe had mostly been mulling over the growing technical, civil, commercial, and military phenomena kindled by GPS and the growing U.S. monopoly in PNT technology. Now this Council resolution invited the European Commission to undertake a number of actions. The Commission was invited to initiate or support work on a European complement to GNSS-1 and to initiate or support work needed for the design and organization of an independent global navigation satellite system for civil use i.e. GNSS-2, which later became Galileo. It also stated that, if possible, the future GNSS-2 should be operated on a private-enterprise basis and the possibility of private-sector financing for the activities noted above should be examined.[58] In addition, the communication established the GNSS High Level Group to

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[57] Barbance and Bergquist, "Satellite Navigation Activities," 155-161. And Council of the European Union, "Council Resolution of 19 December 1994 on the European Contribution to the Development of a Global Navigation Satellite System (GNSS), (94/C 379/02), Official Journal of the European Communities C 379 (Brussels, EU, December 31, 1994), 0002-0003.

[58] European Commission, "Global Navigation Satellite System, High Level Group: Council Resolution of on the European Contribution to the Development of a GNSS," 94/C 379/02. *Official Journal of the European Union*, (Brussels: December 31, 1994) 2 - 3. Also see web version at http://cordis.europa.eu/telematics/tap_transport/deployment/53.htm (accessed January 9, 2008).

assist the EC in its tasks.[59] The GNSS High Level Group's job was to coordinate activities in the satellite navigation field and to assist with the definition of all potential user requirements, to propose resource options, and to identify ways to initiate or support work on GNSS-1 and GNSS-2 as noted just above. The GNSS High Level Group was composed of national government representatives, ESA, EUROCONTROL, industry, users and telecommunications operators, with associate status being giving to such international organizations as ICAO and the International Maritime Organization (IMO).

In December 1994 ESA began to consult with the EU in order to prepare proposals for a European contribution to GNSS-1. EGNOS was already being tested under the ESA ARTES 9 program. In addition, ESA's pre-development work on the future Galileo system was also located under ARTES 9.[60] By 1996 Germany, France, Italy and the United Kingdom had contributed over 100 million European Currency Units (ECUs) to ARTES 9, which is more than the program required and an indicator of strong Member State interest in the project.[61] In addition, the ETG established the following roles with regard to EGNOS: the EC provided the political support and financial support, ESA conducted R&D, implemented the ground segment and would eventually operate EGNOS during testing and technical validation, and EUROCONTROL would provide civil aviation and certification requirements.[62]

By this time the civil aviation community had defined its requirements for a GNSS more stringently than any other civilian PNT users. The aviation communities'

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[59] Commission, "Global Navigation Satellite System - High Level Group."
[60] Barbance and Bergquist, "Satellite Navigation Activities," 155-161.
[61] Madders, *A New Force at a New Frontier*, 563. The European Currency Unit was a composite monetary unit consisting of a basket of European Community currencies that served as a predecessor to the Euro. InvestorWords.com, "European Currency Unit," WebFinance, Inc. http://www.investorwords.com/1770/European_Currency_Unit.html (accessed May 6, 2008).
[62] Barbance and Bergquist, "Satellite Navigation Activities," 155-161.

requirements were the most stringent due to the high speed, highly dynamic nature of aviation and the corresponding need for high safety standards.[63] They had strict requirements for the safety and reliability of the system which necessitated the need for system monitoring and the ability to alert users, within seconds, when there was a problem with the signal. Second, they needed liability protection. Of course, the civil aviation community also required that it all be done in a cost efficient manner. GPS did not adequately meet these rigorous standards, although the United States continued to adjust GPS policy to civilian needs and the growing PNT commercial market.

In 1995 GPS was declared fully operational and in March 1996 the White House released a new "U.S. Global Positioning System Policy," which presented a strategic vision for the future management and use of GPS.[64] It is significant in a number of ways. On the importance of GPS, it states:

> GPS provides a substantial military advantage and is now being integrated into virtually every facet of our military operations. GPS is also rapidly becoming an integral component of the emerging Global Information Infrastructure. The growing demand from military, civil, commercial, and scientific users has generated a U.S. commercial GPS equipment and service industry that lead the world.[65]

By 1996, about 100,000 GPS receivers were being produced per month.[66] This illustrates again that satellite navigation services as provided by GPS had gone from a virtually unknown, niche interest of the aviation community, into a critical military

[63] Commission, "Global Navigation Satellite System - High Level Group."
[64] Presidential Decision Directive/National Science and Technology Council-6, "US Global Positioning System Policy," (March 28, 1996).
[65] Ibid
[66] P. Hartl and M. Wlaka, "The European Contribution to a Global Civil Navigation Satellite System." *Space Policy*, 12 (1996): 168.

capability and commercial enabler.[67] The policy stated the United States would continue to provide GPS Standard Positioning Service for peaceful civil, commercial, and scientific use on a continuous worldwide basis and free of direct user fees. In essence the United States was offering GPS as a global public good and referred to GPS as a "global utility."[68] The fact that the U.S offered GPS free of direct user fees made it difficult for possible commercial competitors, including Europe, to justify spending the large sums needed to build a comparable system. Why build and pay for a satellite navigation system which would essentially provide the same service freely provided by GPS? The argument over this question became central to the debate in Europe over the need for a European GNSS-2 component.

In addition, the 1996 GPS Policy also declared the U.S. intention to discontinue the use of Selective Availability "within a decade," meaning that the most accurate signals from GPS would be available to civilians, making it even harder to justify the development of a competing system. The 1996 GPS policy also established that the United States would advocate GPS as the international standard for satellite navigation. Organizationally, the 1996 GPS policy set up the permanent interagency GPS Executive Board (mentioned previously) jointly chaired by the DoD and DoT. This would ideally provide a more appropriate institutional framework given the significance of GPS to civil and commercial users.

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[67] The National Defense Authorization Act for FY 1994 (Public Law 103-160), as amended by National Defense Authorization Act for FY 1999 (Public Law 105-261), mandates that '. . . after September 30, 2005, funds may not be obligated to modify or procure any Department of Defense aircraft, ship, armored vehicle, or indirect-fire weapon system that is not equipped with a Global Positioning System receiver.' From Hays, "What is Space Power and Does it Constitute a Revolution in Military Affairs," footnote 103.
[68] Presidential Decision Directive/National Science and Technology Council-6, "US Global Positioning System Policy" (March 28, 1996).

Overall, the policy attempted to balance U.S national security requirements with the goal of making GPS accepted globally as a public good, and for the benefit of U.S. commercial interests. It states, "In the management and use of GPS, we seek to support and enhance our economic competitiveness and productivity while protecting U.S. national security and foreign policy interests."[69] It also set 2000 as the year in which the President would begin making an annual determination on the continued use of GPS Selective Availability.

The year 1996 is noteworthy for other reasons as well. The retirement of the Transit navigation satellite program at the end of 1996 closed one chapter in the history of U.S. military satellite navigation.[70] But a new chapter was opened with the introduction of the NAVWAR concept by the U.S. Air Force (described below). As the new GPS policy noted, GPS receivers were now integrated into virtually every facet of the U.S. military and GPS signals were a vital part of the Global Information Infrastructure.[71] The United States recognized that such a critical system needed to be protected from disruption. Likewise, the United States saw that it needed the ability to deny GPS signals to hostile users while simultaneously ensuring unimpeded use of GPS signals by American and Allied forces.[72] This is more difficult than it may seem.

Since the GPS system is a global system, and due to the way the system must broadcast its navigation signals continuously, the GPS system cannot simply be "turned off" to prevent hostile use in a local or regional area. Operating GPS satellites in such a

[69] Presidential Decision Directive/National Science and Technology Council-6, "US Global Positioning System Policy" (28 March 1996).
[70] Danchik, "An Overview of Transit Development," 8.
[71] The NAVWAR concept is part of the broader U.S. space control and space superiority doctrine which also developed with increasing ardor in the 1990s.
[72] Beidleman, "GPS vs Galileo," 137.

way so as to affect the availability or quality of their navigation signals would affect users globally including American, allied, or friendly forces. Therefore, the NAVWAR concept focused on local area jamming of the GPS unencrypted signal in order to deny it to an enemy while allowing friendly users to continue using the encrypted signal locally, and all GPS signals elsewhere in the world. Later, U.S. NAVWAR priorities and signal protection and jamming issues became a main point of contention between the United States and the EU. Nevertheless, the U.S. development of the NAVWAR concept and NAVWAR capabilities made European decision-makers more uncomfortable than ever about GPS and having to rely upon a system owned and operated by a military outside of the EU.

Against the backdrop of the U.S. success with GPS and these new aspects of U.S. GPS policy, Europe's effort to prepare an alternative satellite navigation system continued to slowly move forward. In November 1995 Eurospace presented its view that:

> To secure the rich benefits [of satellite navigation], the EU, ESA, and EUROCONTROL must act swiftly to promote a strategy whereby Europe gains the technology and a share in the control and exploitation of any future GNSS market. Their urgent and robust action is crucial to Europe's future in this commercial field.[73]

Meanwhile, the European Tripartite Group of actors made progress along the two lines of action they had decided upon in December 1994: first EGNOS, then a European GNSS-2. On 27 June 1996, acting on behalf of the European Tripartite Group, ESA leased two Inmarsat navigation transponders from Deutsche Telecom and France Telcom

[73] Eurospace, "Space: a Challenge for Europe," *Space Policy* (1995): 227. Eurospace is the European space industry organization with members drawn from the major space companies in Europe.

for five years. These navigation transponders formed the heart of EGNOS.[74] In parallel, the EC and ESA conducted a series of studies on GNSS-2 concepts.

In June 1996 the European Parliament and European Council adopted guidelines for the development of the Trans-European Networks[75] and confirmed that satellite navigation was an integral part of that effort.[76] The European Council also agreed on 17 June 1996 on the need within a year for a Tripartite agreement on a European Satellite Navigation Program including EGNOS and preparatory work for a European component of GNSS-2. Nevertheless, the effort for a European component of the GNSS continued to develop very slowly throughout 1996 and 1997. In contrast, by 1997 GPS receivers and software were being supplied by over 300 vendors and had reached over $3 billion in sales.[77] Against this backdrop, the EC focused its attention on two key areas: identifying possibilities for joint approaches with the United States, Russia, and others, and clarifying what an independent European system would look like and how much it would cost.[78]

On 21 January 1998, the EC Communication, "*Towards a Trans-European Positioning and Navigation Network: including a European Strategy for a Global Navigation Satellite System (GNSS)*," confirmed the importance of GNSS to Europe's transportation infrastructure and identified three broad options for Europe for the design and implementation of GNSS-2: a joint global system with all major players; the EU developing a GNSS with one or more international partners (particularly the United

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[74] Madders, *A New Force at a New Frontier*, 548.
[75] Barbance and Bergquist, "Satellite Navigation Activities," 155-161.
[76] P. Hartl and M. Wlaka, "The European Contribution to a Global Civil Navigation Satellite System." *Space Policy*, 12 (1996): 171.
[77] Stephen B Johnson, "Space Business," in *Space Policy and Politics*, ed. Eligar Sadeh (Dordrecht, The Netherlands: Kluwer Academic Publishers, 2002), 275.
[78] European Commission, *Galileo*: *Involving Europe in a New Generation of Satellite Navigation Services*, COM (1999) 54 final (Brussels, EC, February 10, 1999), iv.

States or Russia); or the independent development of the EU's own system.[79] Another option, the option to do nothing and simply rely upon GPS, was called the "Zero Option." The Communication advocated the joint development of a civil GNSS with international partners and it stated that by 2000 the European Market for GNSS-related equipment and services was expected to be 4 billion ECUs.

In response, in March 1998 the European Council requested the EC to intensify contacts with the United States, Russia, and Japan in order to assess the potential for joint development of a civil GNSS system and requested the EC to accelerate examination of the possible development of an autonomous European satellite navigation program.[80] The discussions with the United States were an attempt by Europe to have GPS internationalized and reflected growing European sentiment that the GPS system should not be under the sole control of the U.S. military.[81] European decision-makers knew the significance of GPS and had to consider two possible worst case scenarios; someday the United States could turn off the GPS signal, or someday the United States could begin charging a user fee. Clearly, GPS did not represent an interdependent relationship. Rather, Europe was dependent on the United States to provide the PNT information it needed. In a sense, Europe was dependent on the United States for an increasingly vital resource. Naturally, European decision-makers held the position that the international nature of satellite navigation required that it be dealt with as an international matter. In

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[79] Commission of the European Communities, *Communication from the Commission to the Council and the European Parliament: Towards a Trans-European Positioning and Navigation Network including a European Strategy for a Global Navigation Satellite System (GNSS)*, COM (98) 29 final (Brussels: EC, January 21, 1998).
[80] Commission, *Galileo*, COM (1999) 54 final, 2.
[81] "European Commission Calls for Greater European Role in GPS," *Global Positioning And Navigation News*. February 11, 1998.
http://proquest.umi.com.proxygw.wrlc.org/pqdweb?index=3&did=26195549&SrchMode=3&sid=1&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1223442451&clientId=31812&aid=1 (accessed January 12, 2008).

this context the EC made initial contact in 1998 with many other countries which had indicated an interest in cooperating with the EU to benefit from GNSS-1 and to consider cooperation on GNSS-2, including: Australia, Canada, China, Iceland, India, Korea, Turkey, Switzerland, and countries of Africa, South America and the CIS.

However, the 21 January 1998 communication also made clear that European interests had to be protected in any agreement for a jointly developed GNSS-2 system. The Communication said that the following requirements had to be met for any joint development: a full European role in the control of the system; full European participation in its development; and an opportunity for European industry to compete in all segments of the market.[82] In these requirements, we see themes that go all the way back to the *Causse Report* in 1967, over 30 years earlier, which emphasized Europe's desire for international cooperation on space projects, but not with Europe being consigned to a secondary, junior partner role. The 21 January 1998 communication goes on to state that if an international partnership cannot be formed based upon the requirements above, the EU would need to choose an independent system. Recall that similar sentiments were expressed in July 1971 with regard to the Aerosat program. Unsurprisingly perhaps, in discussions between the United States in May, June and November 1998, it "rapidly became clear" that the United States could not consider joint ownership and control of GPS, primarily due to military reason.[83]

So the EC focused on drawing up a coherent proposal for an independent GNSS-2 which would include institutional, legal, technical, operational, financial, security, and

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[82] Commission, *Towards a Trans-European Positioning and Navigation Network*.
[83] Commission, *Galileo*, COM (1999) 54 final, 5. Also Europa, Activities of the European Union, Summaries of Legislation. "Satellite Navigation: Galileo." http://europa.eu/scadplus/leg/en/lvb/124205.htm Summarizes European Commission, *Galileo: Involving Europe in a New Generation of Satellite Navigation Services*, COM (1999) 54 final (Brussels, EC, February 10, 1999).

defense considerations. To this end, in mid-1998 the EC established the GNSS-2 Forum. Its membership included representatives of users, government agencies, academics, industrialists, and various EC units.[84] Meeting from July to December 1998, they synthesized the various studies that had been carried out in Europe previously, including those done by ESA, and concluded in the Forum's final report that the future GNSS should be based on a combination of GPS, (which is what the EGNOS program accomplishes) and a global, independent, European-led component. It also concluded that the European-led component should include contributions from third countries and that the system should have two levels of service, a basic service free of charge, as long as GPS service was free, and a service for users with stringent requirements for signal availability and reliability. In addition, the GNSS-2 Forum considered a PPP as a priority and recommended more analysis on how to attract private investment. In addition, the European aerospace industry made its opinion known in a Eurospace report which emphasized the need to develop a minimum capability in space applications and space access to avoid commercial, technological, and political dependence on other countries, particularly the United States, while commercial PNT markets continued to grow.[85] Commercial markets, the aerospace industry, and PPP's are discussed in greater detail in separate sections below.

On 13 January 1999 the European Parliament adopted a resolution which called for the EU Member States to convene a European Space Council at the Head of State or Government level and asked the EC to prepare a coherent strategy for the development of

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[84] Commission of the European Communities, *Commission Working Document: Towards a Coherent European Approach For Space*, SEC (1999) 789, final (Brussels, June 7, 1999).

[85] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 201.

a Trans-European satellite navigation system. On 25 January 1999 U.S. Vice President Gore announced that future GPS signals would carry two new civil signals. The first new signal would for general use, non safety-of-life applications while the second new signal would be for safety-of-life applications. This announcement served to undercut commercial arguments that Europe's independent GNSS-2 would be an improvement over GPS and be able to charge for safety-of-life services, which GPS did not provide at that time.[86]

Nevertheless, the Commission offered an outline of available strategies for GNSS-2 and followed with a refined proposal on 10 February 1999 when it the released the EC Communication *"Galileo: Involving Europe in a new Generation of Satellite Navigation Services."*[87] **This Communication marked the official starting point of the program named "Galileo," although it was not approved by the European Council or by ESA until later in the year, and money was not released until the end of 1999.** Nevertheless, it marked the culmination of years of studies and the convergence of the many trends outlined in this chapter, including acknowledgement that PNT data was now indispensable.

The February 1999 "Galileo" Communication indicated that reliance upon satellite navigation was a foregone conclusion, and noted that satellite navigation was central to all forms of transport and many other activities including manufacturing industries and the service sector. It asserted that satellite navigation was crucial for the Single Market because it was crucial for the integration of the European transport system. Europe's reliance on satellite navigation, it noted, raised strategic questions as well. The

[86] Commission, *Galileo,* COM (1999) 54 final, 16.
[87] Commission, *Towards a Trans-European Positioning and Navigation Network.*

fact that European sources of PNT data (GPS and GLONASS) were not under European control raised concerns with regard to the CFSP. The "zero option" was not recommended even though it was the most cost effective in the short term.

In addition, the February 1999 "Galileo" Communication clearly shows that the timing of the Galileo project was being driven largely in reaction to GPS. It states:

> An urgent decision is needed: the US [sic] is committed to developing GPS and reinforcing its global dominance. They already have a head start. Unless Europe gives a firm political commitment now to develop a European system, to be in place at the same time as the next generation of GPS, it will simply be too late.[88]

Nonetheless, the Communication also showed that international cooperation on Galileo was desired. The Communication recommended that, although Europe should build an independent system, it should be fully interoperable with GPS, and open to participation from other countries, in particular Russia. This indicates that Galileo's future capabilities were considered in a non-zero sum light, rather than as a zero-sum "European-only" capability. The benefits Galileo would provide to Europe would also be provided globally.

Section 2 through section 5, below, look at how additional trends converged in the late 1990s and how these trends are also reflected in the February 1999 Communication. However, before going there, this section concludes with more of what occurred in 1999. The events of 1999 served to hammer home the point that satellite navigation was now a crucial military capability.

The military significance of satellite navigation was driven home almost immediately after the February 1999 "Galileo" Communication was released. On 24

[88] Commission, *Galileo*, COM (1999) 54 final, iv.

March 1999 NATO went to war in Kosovo. The NATO bombing campaign, led by the United States, conclusively demonstrated the affect PNT had on modern warfare and demonstrated the great strides the U.S. military had taken in integrating PNT into its weapons systems and operational concepts. Although it was a NATO campaign, the United States was so technologically dominant, especially in the area of satellite navigation and GPS guided munitions, that U.S. aircraft flew over 90 percent of bombing sorties compared to NATO European members.[89] The Kosovo campaign laid bare the quickly widening military "capability gap" between the United States and Europe, with GPS as the technological centerpiece. Furthermore, it harshly demonstrated Europe's total military dependence on the United States.

Late in April 1999, as the bombing campaign raged on, an informal Council of the European Union - Transport Ministers gave informal approval to the EC's Galileo proposals of 10 February.[90] This action prepared the ground for the ESA Ministerial Council in May 1999 to agree to co-fund the Definition Phase of Galileo to the tune of 40 million euros, contingent upon the official allocation of 40 million euros in matching funds by the EU. [91] In another important move, the ESA Council also called on the ESA Executive and the European Commission to elaborate a coherent European Space Strategy, which will be discussed in more detail in Chapter Five.

The Kosovo bombing campaign stopped on 10 June 1999. Subsequently, on 17 June the Council of the European Union - Transport Ministers, officially endorsed the

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[89] Valasek, "Galileo's 'Strategic' Role," 40.
[90] Commission, *Towards a Coherent European Approach For Space,* SEC (1999) 789, final.
[91] Galileo, General information, (15 Mar 2001), (Slides) at *http://ec.europa.eu/comm/space/doc_pdf/galileo_presentation.pdf*). Also, GalileoSat program approved by ESA Ministerial Council. See also Vidal Ashkenazi, "The Challenges Facing Galileo," *Space Policy* 16 (2000): 185.

EC's February communication on Galileo and on 19 July 1999 the Council resolution giving authorization for the Galileo program to enter the Definition Phase was approved. The European Transport ministers agreed that for political, economic, and strategic reasons, Europe needed an independent satellite navigation capability. But the EU did not make a major financial commitment to the program at that time.[92] It was also at this point in time that several European governments agreed that an autonomous satellite navigation capability must serve as the basis for Europe's emerging security and defense policy.[93] Predictably, France, Germany, Italy and the United Kingdom started vying for lead roles.

June 1999 was also the point in time that the EC released the *"Commission Working Document: Towards a Coherent European Approach For Space,"* which reported the result of discussions between ESA and the Commission on practical measures needed to implement closer cooperation between the two parties and which identified steps and methods for eventually designing a new European space policy.[94] This working document is discussed more in the next section.

The culminating point was in December 1999. On 8 December ESA signed the contract for the GalileoSat study, i.e. the ESA contribution to the Definition Phase. European Union funding from the Trans-European Network budget for the launch of the Definition Phase was approved the same week. Subsequently, the EC and ESA kicked off

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[92] Council of the European Union, "Council Resolution of 19 July 1999 on the Involvement of Europe in a New Generation of Satellite Navigation Services: Galileo Definition Phase," 1999/C 221/01 *Official Journal of the European Communities* (Brussels, EU, August 3, 1999). Also see "Go Ahead Given for Phase 1: Definition Phase," *Space Policy* 16 (2000) 185-188. The Council, however, did not commit to a major financial commitment. Lembke, *The Politics of Galileo,* 8.

[93] Vicente Gomez, "Europe without Fractures: A Spanish View of the European Space Strategy," *Space Polic*y 17 (2001): 91-95.

[94] Commission, *Towards a Coherent European Approach For Space,* SEC (1999) 789, final, 3.

contract calls and signed four major contracts with industry to conduct Galileo studies from November 1999 to December 2000.[95] Galileo's Definition Phase was underway.[96]

This section described chronologically the American and European efforts to develop satellite navigation capabilities, how GPS became indispensable in the 1990s for military, civil and commercial purposes, and how Galileo was a reaction to these new circumstances. Since this section was so lengthy we'll pause a moment to consider what we have found out so far.

Interim analysis: At this point in the study it is reasonable to assert that the chronology above shows that while the American and Russian satellite navigation programs were military projects, clearly indicating their realist drivers, the collective European efforts to develop satellite navigation, beginning in the 1960s, were based more heavily upon liberal drivers such as efficiency, commerce, cooperation, public goods, and civilian uses. The purposes for which Galileo was intended, the nature of the organizations and decision-makers involved in the effort, the desire for international cooperation, and the sources of the funds to pay for the efforts during this period are solid indicators that liberal drivers carried the most weight.

The Aerosat and NAVSAT projects indicate that from the 1960s to at least the mid-1990s European efforts to develop satellite navigation capabilities were primarily for the purpose of providing a public good which would increase the efficiency of the aviation community and improve the flow of commerce among European nations. The international nature of global air traffic management also made cooperation with other

[95] Genesis Office, "Launch of the Galileo Definition Phase," *Galileo Newsletter*, (January 2000).
[96] "Galileo", General information, (15 Mar 2001), (Slides) at http://ec.europa.eu/comm/space/doc_pdf/galileo_presentation.pdf)

countries highly desirable. In addition, later in the 1990s the EC consistently sought international collaboration on GNSS-2 with the United States in particular, and also Russia. When close collaboration with the United States was ruled out, the EU still desired to make Galileo highly interoperable with GPS, for their mutual benefit, and continued to seek other international partners. This indicates that absolute (non zero-sum) gains weighed more heavily than relative gains in European decision-makers minds. This study considers these aspects as significant liberal factors.

Organizationally, up until the mid-1990s, ESA took the lead in European satellite navigation efforts. ESA, of course, was a strictly civilian organization which was prohibited from participating in projects which were for other than "peaceful purposes." It is therefore reasonable to conclude that ESA's heavy participation in the development and funding of an independent European satellite navigation capability indicate that liberal factors weighed more heavily in European decision-makers assessment's of the need for Galileo when the decision to enter the Definition Phase was made.

Likewise, DG TREN's leadership role in conceiving the Galileo program indicates that liberal factors weighed more heavily than other factors. The European Commission does not have jurisdiction over military and defense matters and DG TREN is focused organizationally on improving the efficiency of Europe's infrastructure and, in turn, Europe's Single Market. In addition, building a system which improved on an existing system (GPS) and which provided more elaborate services and created new commercial markets was totally consistent with the traditional European approach and focus on economic benefits and efficiency.[97] DG TREN viewed satellite navigation as a tool to

[97] Xavier Pasco, *A European Approach to Space Security* (College Park, MD: University of Maryland, 2006), 13.

help improve Europe's Trans-European Networks, and most of the EU's funds for satellite navigation came from its budget. In addition, in the 1990s, a portion of the money for GNSS-2 research and development also came from the EC's research budget, i.e. the 4th and 5th Framework Program funds.[98] These are solid indicators that liberal factors dominated.

In addition, as we know, the three discrete European IOs that took the lead on developing a European satellite navigation capability in the 1990s; ESA, DG TREN, and EUROCONTROL, were led by Member States' Research Ministers and Transport Ministers respectively. These were the key decision-makers at many points along the way. **The point is that one must be very skeptical not to believe that these three discreet civil organizations, two intergovernmental in character and one supranational in character, and led by a combination of Member State Transportation and Research Ministers, are anything but very solid indicators that liberal factors outweighed realist factors** in the decision to approve Galileo's Definition Phase.

In contrast, it is difficult to find any defense organizations that had a hand in Galileo organizationally or financially, and it is not clear that full thought was given to Galileo's military implications for Europe, for the United States, or for NATO.[99] In 1995, a RAND study noted that Europe's "general level of awareness" of GPS technology and applications was relatively low, and that internal European discussions of

[98] Commission of the European Communities, *Communication from the Commission to the Council and the European Parliament: The European Union and Space: Fostering Applications, Markets and Industrial Competitiveness*, COM (96) 617 final (Brussels: EC, December 12, 1996).
[99] Myron Hura et al., "Chapter 6: Space Developments," in *Interoperability: A Continuing Challenge in Coalition Air Operations* (Santa Monica: RAND, 2000), 72.

satellite navigation did not seem to be driven by military concerns.[100] Up to this point, this study also did not uncover any defense or military authorities having veto power or control over Galileo design decisions. The fact that European militaries or defense ministries have not played a significant role in Galileo to date is not surprising. In the 1990s Europeans were not that ambitious for military power.[101] This makes it difficult to argue that realist factors weighed heavily in European decision-maker's assessments of the need for Galileo.

A few more points. On the technical level the fact that the services Galileo will provide are structured according to the quality of the signal provided instead of being designed according to the type of user, i.e. civilian or military, as is the case for GPS, is another indicator that liberal factors weighed more heavily. On the timing of when Galileo should become operational a couple of arguments are made. First, Galileo must be operational before the new European Union Single Sky air traffic control system can become operational.[102] In 1999 the EC projected the new air traffic control system would need to be operational by 2010. Second, the February 1999 "Galileo" communication said Galileo's development and deployment schedule would be driven by the need to capture market share from GPS, before the launch of the next generation of GPS satellites fixed GPS performance flaws, and before GPS could be irrevocably established as the global PNT standard.[103] If this is so, then this may be categorized as another liberal indicator. Logically, the GPS upgrade schedule should not be an important consideration from a realist point of view. In the realist perspective the development of a material

[100] Paceet al., *The Global Positioning System*, 37.
[101] Robert Kagen, *Of Paradise and Power: America and Europe in the New World Order*, (New York: Knopf, 2003), 55.
[102] Giulio Barbolani di Montanto, ESA official, interviewed by author, Brussels, BE, December 7, 2007.
[103] Commission, *Galileo*, COM (1999) 54 final.

capability should be done for power and security, or in reaction to the security dilemma and the need to balance. But GPS already existed, so if balancing was the driver than Galileo should simply be developed as quickly as possible, regardless of any GPS improvement schedule.[104] This study categorizes these two timing aspects as liberal factors.

Nevertheless, many other dynamics were affecting the environment from which the Galileo program sprung in the 1990s. The EU's evolution as a more significant actor in Europe along with its growing roles in European space activities and security and defense matters affected the context within which the decision to begin Galileo's Definition Phase was made. In addition, the rapid growth of the highly competitive commercial space services market, the consolidation of the European space industry, and the preference to use Private Public Partnerships in public infrastructure projects also affected the decision. French, German, Italian, and British national level interest were also reflected in the Galileo decision in 1999. This chapter moves forward to describe these trends and weigh their influence on European decision-makers' assessments of the need for Galileo in the 1990s.

3. Space and Security in the EU.

This section shows that growing EC interest in space and security affairs during the 1990s culminated in 1999 at the same point at which Galileo's Definition Phase was approved, making it more difficult to discern if the EC's new found security and defense

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[104] GPS NAVSTAR satellites have been continuously improved to provide more capabilities to both military and civilian users. Versions include Block II, IIR, IIR-M, GPS III.

interests were responsible for driving Galileo, or if they were intervening variables which affected the decision, but were not the primary driver.

The 1987 Single Europe Act marks the starting point for this discussion on both the EU's growing role in European security affairs and as a central actor in European space activities. It is beyond the scope of this study to trace the history of the European Union prior to 1987 except to emphasize the economic roots and the economic focus of the EU's predecessors, the European Coal and Steel Community and the European Economic Community (EEC), also called the Common Market. It is also beyond the scope of this study to describe the EU's organizational intricacies except those which matter directly to this study, as addressed in Chapter Two and below. From 1987 on, however, the evolution of the EU, including its evolving interest in taking on a security role, began having implications for the European space sector. This section gives a very brief description of the evolution of the EU's growing interest in space in the 1990s and provides an overview of its growing interest in security.

The EU had only a few shallow roots planted in European space activities prior to the late 1980s. ESA and its predecessors ELDO and ESRO had taken the lead on collective European space activities so that up until 1987 the Commission's relation to European space activities was intermittent and minor in scope.[105] Occasionally, the European Parliament's Committee on Energy, Research, and Technology produced reports concerning the effort the EEC was making in the space arena and in 1985 it recommended that the Commission create an internal organization to handle space activities for the Commission, and citing the fear of a loss of European autonomy, questioned ESA's participation in the U.S. Space Station program. The committee also

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[105] Madders, *A New Force at a New Frontier,* 570.

called for a greatly expanded European role in space activities, to be executed by ESA, but to also be partially funded by the Commission. An autonomous lunar base was the goal.[106] But these parliamentary efforts did not bear much fruit.

The EU's interest in space also had roots within EEC research and development (R&D) activities, as well as growing activity in environmental matters. The SEA in 1987 formally added R&D as a responsibility of the EEC, along with providing for a Single Market by the end of 1992 and with updating, strengthening, and extending the EEC, Euratom, and the ECSC treaties. R&D was added for the purpose of strengthening Europe's technological base, with the goal of making European industry more competitive internationally.[107] In addition, the SEA added environmental issues to the Community's competence. Since space activities cut across both of these new areas, space topics gained a new level of importance within the EEC.

The Commission issued its first position paper on space on 19 July 1988 entitled "*The Community and Space: A Coherent Approach*," with the result that space issues changed within the EEC from a matter dealt with on an ad hoc nature into an institutionalized EEC policy area. The report pointed out that Europe lacked a coherent overall space policy which incorporated economic, technological, industrial, commercial, and defense considerations. This was a swipe at ESA for its failure to generate a coherent space policy for Europe, which was mandated in Article II of the ESA Convention, and bolstered the paper's conclusion that the political and institutional significance of the European Community, along with its legal competence, made broader

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[106] Ibid.
[107] Madders, *A New Force at a New Frontier,* 568.

Community action in space possible and desirable.[108] The report also suggested that the EC should contribute monetarily to European space activities, especially in space applications, (another weak area for ESA), and suggested that space applications should become part of the "socio-economic framework" of the Community.[109] One of the hidden messages in the communication was that the doctrine of the "primacy of Community law" gave the EC more legitimacy to manage Europe's space affairs than ESA.[110] Nevertheless, the report emphasized that links with ESA should be strengthened and it supported the establishment of a space policy coordination unit within the Commission for internal EC coordination and to provide consistency in interactions with external actors.

Soon thereafter the Commission and ESA established a formal relationship and by the end of 1989 five working groups were formed in order to organize working relationships between ESA and the Commission in major functional areas and provide regularized communication channels between parties. Likewise, interfaces were established between the various internal Commission organizations with space-related interests and activities.

At this time, the Western European Union (WEU) had not yet been folded into the EU; however, it is noteworthy that in 1990 the WEU Assembly adopted a resolution calling for the urgent formation of a collective European military space capability in the form of optical and synthetic aperture radar, Earth observation satellites, and for a WEU satellite image-processing and interpretation agency. The WEU Satellite Center, which

[108] Dr. Kevin Madders interprets it this way. Madders, *A New Force at a New Frontier,* 579.
[109] Commission of the European Communities, *Communication from the Commission: The Community and Space: A Coherent Approach,* COM (88) 417 final, (Brussels: EC, July 1988).
[110] Dr. Kevin Madders interprets it this way. Madders, *A New Force at a New Frontier,* 579.

processes and interprets commercial satellite imagery, eventually came out of this resolution (and became incorporated as an agency in the European Union as the "EU Satellite Center" on 1 January 2002),[111] but nothing ever officially came out of the proposed Earth observation satellite system.[112]

The end of the Cold War and the growing commercial orientation and economic importance of space activities in a sector previously dominated by government and security interests (discussed below), in combination with the development and strengthening of the European Union, as well as the conflicts in the Balkans, altered the context in which European space activities went forward into the 1990s. In March 1991 the European Parliament hosted an informal hearing on European space policy and it concluded that although ESA currently had the lead role in collective European space efforts, ESA did not have the political power to implement and enforce a comprehensive European Space Policy. On the other hand, the European Community had the legal and institutional wherewithal to initiate and impose common policies on Member States, making the EEC a critical actor for helping Europe benefit from space activities. The European Parliament thereby invited the Commission to define and implement a European space policy and to generate proposals for specific space applications.[113]

Following that, the Commission chartered the "Advisory Panel on the European Community in Space" to provide recommendations on which space activities the Commission should take part. In September 1991 the panel presented its report "The

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[111] The European Union Satellite Center, http://www.eusc.europa.eu/index.php?option=com_content&task=view&id=2&Itemid=10 (accessed January 22, 2008).
[112] Madders, *A New Force at a New Frontier*, 186.
[113] Ibid., 574.

European Community, Crossroads in Space."[114] Known as the "*Gibson Report*," it identified the need for the Commission, as well as the European space sector, to begin developing a coherent policy for Earth Observation satellites in order to coordinate the Commission's environmental and agricultural policies, and implied the need for Europe to have an independent (of U.S. military) navigation satellite system.[115]

Meanwhile, in June 1992 the WEU's Petersberg Declaration was announced. It set out humanitarian, rescue, peacekeeping, crisis management, and peacemaking tasks for which the WEU Member States would contribute military forces to NATO and the EU.[116] Seventeen months later, these so-called "Petersberg Tasks" were incorporated into the Maastricht Treaty as a part of the CFSP (see below), and indicated the beginning of a growing European approach to security issues outside the context of NATO.

In September 1992 the Commission presented its second communication on space, *"The European Community and Space: Challenges, Opportunities, and New Actions,"* which was heavily influenced by the *Gibson Report* and stressed the need for a European Earth observation capability in order for Europe to have the capability to adequately monitor the environment. In addition, the Space Advisory Group (SAG) was created in 1992 which included representatives from ESA, the EC, and their Member States, and which became the central institution for coordinating the activities of ESA and the EC in the early 1990s.[117] Although the above activities show that enthusiasm for

[114] The European Community, "Crossroads in Space," EC Report EUR 14010 (Luxembourg: Office of Official Publications of the EC, 1991). Known as the Gibson report after former ESA Director General Roy Gibson.
[115] European Commission official, May 26, 1998, quoted in Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 187.
[116] The WEU was a dormant organization throughout most of the Cold War, but once again became active in the 1990s.
[117] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 189.

space was rising within the EC, overall progress toward a stronger role for the EC in the European space sector was slight.[118]

The context for European space activities changed on 1 November 1993 when the Treaty of the European Union, also called the Maastricht Treaty, entered into force.[119] However, no major changes in the EC's space activities immediately followed. Satellite navigation matters were starting to take root at that time with regard to EGNOS and the ARTES 9 program in ESA (see previous section) in early 1994, while the European Parliament also attempted to push the European space policy issue forward with its report *"European Space Policy 2000."*[120] But this report also did not have much success in moving the creation of a European space policy forward. However, in June 1994, as described previously, the European Council endorsed the *Bangemann Report.* It recognized that a new phase in the EU's satellite policy could only be achieved in the context of the creation of Trans-European Networks; that European industry should be actively involved in the development of world-wide systems; and that private sector funding should be used in order to fulfill this objective. A few years later the Galileo program reflected these recommendations in many respects.

The EC Directorate General for Research and Development, which provided the organizational home for the EC's space policy coordination unit also had interests in

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[118] Madders, *A New Force at a New Frontier,* 576.

[119] The Maastricht Treaty was a series of Treaties designed to bring closer political, economic, and social unity as well as a common foreign and security policy, and a single currency to Europe by 1999. The treaty carried forward the existing Paris and Rome treaties and the SEA, renamed the EEC the EC, and granted it new powers. The EC's competence in space matters grew most directly out of the EC's competence in R&D, and in Transport policy. The EC was established as the first pillar of the EU, and is the EU's executive power. It also has the sole power to initiate legislation within the EU, and the European Parliament and the Council cannot approve any legislation that the Commission did not propose. It is responsible for the single market, EU economic policy and the numerous activities that support the economy, including such activities as industrial policy, transport policy, research and development, and so forth. In many cases, EU legislation concerning first pillar issues takes primacy over Member States' laws. The second pillar, as we noted in Chapter Two, consists of the CFSP.

[120] Madders, *A New Force at a New Frontier,* 576.

European space activities. As a matter of fact, in 1995, former French Prime Minister Edith Cresson the EU Commissioner for Directorate-General Research and Development at the time, asserted that space activities were a key element of the EU's economic security and cut across many EC competencies.[121] On 12 April 1996 the EC published its third Communication on space, *The European Union and Space: fostering applications, markets and industrial competitiveness.*[122] It stressed the crucial need for Europe to take action to strengthen European presence in space application markets and ensure European competitiveness; and stressed the importance of space applications for the development of the global information society. It also acknowledged the growing issue of multi-use space technologies and stressed that "any European strategy should *ensure the convergence of civil and military effort* in order to avoid duplications and make the best use of the available public funding" (Italics added). It also made an effort to define the roles of the various actors in the European space sector including ESA, European states, industry, and the Commission. In particular, the Commission defined its role as: improving coordination of European research and development policies with industrial policies; improving coordination of European requirements in international negotiations over issues such as orbital slots, frequencies, and licensing; and given the European-wide or global reach of space applications, providing the proper level for consideration of space application issues that are beyond the scope of national governments. But it wasn't until 16 months later, in September 1997, that the EU Council of Research Ministers responsible for space endorsed this EC Communication.

[121] Lungu, "Power, Techno-Economics, and Transatlantic Relations," 13.
[122] Commission, *The European Union and Space.*

Then in June 1998 at the EU Council meeting of Research Ministers, the Council asked the Commission to take measures to "promote synergy" between the EC and ESA.[123] In response, after joint consultations with ESA, the Commission produced the June 1999 "*Commission Working Document: Towards a Coherent European Approach for Space*," which considered measures to implement closer cooperation between EC and ESA. It noted that given the importance of the space sector to the entire European Union, including the information society, the CFSP, technology, science and international cooperation, that the European-level was the appropriate level to bring about the convergence of disparate Member State space activities and promote greater synergy among national level priorities. As such, the document suggests the European Union should take the lead in defining a European space policy, define objectives, and mobilize the means to accomplish them.

The release of this document occurred just days before the European Council's decision to begin Galileo's Definition Phase. The document noted the growing importance of space applications, the need for a coherent approach to space within Europe, the new market oriented approach to space activities, and that "Since the end of the Cold War, the stakes in the race have been shifting from prestige and military supremacy towards market shares and dominance for applications."[124] It also pointed out, however, that global space activities were still largely under the influence and supervision of governments, which provide significant support to their respective space sectors. In addition, it asserted that "a degree of independence and sovereignty" is "what really is at stake," but this rhetoric turns out to be in reference to independence and

[123] Council of the European Union, "Council Resolution: Cooperation Between the EU and European Space Agency," (Brussels: EU, June 22, 1998).
[124] Commission, *Towards a Coherent European Approach For Space*, SEC (1999) 789, 5.

sovereignty in “critical technologies” and “space applications,” rather than a reference to independence and sovereignty in a clear geo-political sense.[125] It also refers to the need for Europe to “control” its PNT resources, but once again coaches it in a liberal frame by saying, “The issue is…what socio-economic benefits Europe would gain from playing a full role in the development of the [Galileo] system (jobs, new products and services), and what degree of control it will have over other systems which its safety critical services will depend.”[126] Such “realist” sounding buzz words as “independence,” “sovereignty,” and “control,” are often found in European Union official expressions of policy, but upon closer examination, they are often used in such a way as to throw doubt upon their usefulness as realist indicators. However, the working paper points out that dual-use applications are an important issue in the definition of space systems and that the Council “could” agree to establish a link for the WEU and the CFSP to bring the various defense interests into the established consultative structures on space policy among the EC, ESA, industry, and Member States.[127] Apparently, at the time of this report in June 1999, the WEU and CSFP were not included in consultations about European space policy; indeed even in 2004 the institutional mechanisms for European military authorities to take control of Galileo’s signals in a time of crisis or war did not exist.[128] This makes it increasingly doubtful that realist factors weighed heavily on the 1999 decision to enter the Definition Phase.

The 1990s trend toward greater European Union involvement in the European space sector reached a culmination point in 1999 with the decision to entire the Definition

[125] Ibid.
[126] Ibid., 22.
[127] Ibid., 8.
[128] Valasek, “Galileo’s ‘Strategic’ Role,” 41-42.

Phase for Galileo. The influence of the European Commission's emerging role in space is seen in the February 1999 "Galileo" communication, as well as in the July 1999 decision to enter the Definition Phase of Galileo. First and most obvious in this regard is that the EC initiated the Galileo program for European Union purposes, under EC supervision, and using 40 million euros in EC funds to pay for 50 per cent of the Definition Phase. This was unprecedented. The "Galileo" communication also proposed that the EU institutional framework be responsible for ensuring a decision-making structure was set up, oversaw international negotiations, and controlled Galileo compliance with all relevant regulations and polices. Galileo came to be regarded as a "flagship" for EC space activities and led the way to greater EC involvement in space.

The next section turns to a discussion of the EU's growing interest in security matters and how security issues began to spillover and affect the EC's space activities. At the end of this section we'll see how the EC's growing concern for space, and the EC's growing activity in the military security realm dovetailed with the 1999 decision to start Galileo's Definition Phase. We will briefly discuss if this indicates that realist, liberal, or ideational factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.

Security evolution: The decision to fund the Definition Phase of Galileo took place at the Helsinki European Council in December 1999, the very same meeting in which European Heads of State and Government set the "Headline Goal" for the creation of a European Rapid Reaction Force, laying the foundation for the new European Security and Defense Policy (ESDP). The Rapid Reaction Force would provide the EU the military capability

to deploy 60,000 troops, along with its naval and air components, sustainable for a year long deployment, and be deployable within 60 days of notice. The nexus of the Galileo decision with the decision to set the Headline Goal is difficult to ignore. But could it be coincidence? The increasing enthusiasm in the EC for space activities along with the trend toward a more active EU role in security and defense affairs became intertwined in the late 1990s with the EC's increasing interest in an independent European contribution to GNSS-2.

European decision-makers' perception of the security threats facing Europe changed during the 1990s along with their perception of the U.S. role, and NATO role, in providing security to Europe. The result was that after nearly 50 years with no military role, the militarization of the EU began to develop in the 1990s. The 1993 *Maastricht Treaty* stated that the Union should "assert its identity on the international scene" and to this end it created the ambitious concept of a Common Foreign and Security Policy into which it incorporated the Petersberg Tasks. However, the Balkans crises in the mid-1990s demonstrated clearly that the EU was impotent on defense and security matters, even in its own backyard. In addition, after the first Balkans crisis, European leaders perceived that American involvement in European crises that were not vital to U.S. interests was not guaranteed. They realized that NATO did not function as an automatic guarantee of American assistance. Top European leaders such as French President Chirac and British Prime Minister Tony Blair realized that the EU had to begin developing a security identity so that it would have credibility in the security arena.

The United States cast a wary eye upon European Union security related activities and was determined to keep NATO the pre-eminent security organization in Europe, even

though the United States simultaneously encouraged Europe to assume responsibility for crisis management and improve its military capability. The European Union found that the political space in which the Petersberg Tasks resided, outside NATO's area of responsibility, and in an area which required collective action among European states due to no single state's capacity to manage these tasks by itself, was sufficient to develop its security and defense identity.

A significant step had been taken on 2 October 1997 when the *Treaty of Amsterdam* was signed. The *Treaty of Amsterdam* made the Petersberg Tasks legally binding on all EU members, whereas previously they only applied to the WEU's members.[129] Nevertheless, European weakness in the Balkan conflicts led to a significant change in British policy in 1998 which led to the creation of the European Security and Defense Policy.[130] British Prime Minister Tony Blair, in what became known as the Blair Initiative, agreed with French President Chirac that the EU needed a military element.

The *Saint Malo Declaration* of December 1998 was an Anglo-French initiative in which the French and British agreed on the need for the European Union to construct a military element. The absence of a European Union military element had been keenly felt with the collapse of Yugoslavia over the course of the 1990s, so it was crucial that France and the United Kingdom, the only two EU states with the capacity to project conventional military force abroad, finally decided to allow moves toward the

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[129] Francois Heisbourg, "Europe's Strategic Ambitions: The Limits of Ambiguity," *Survival* 42, no. 2 (Summer 2000): 6.
[130] Christopher Hill, "The Common Foreign and Security Policy of the European Union: Conventions, Constitutions and Consequentiality" (paper presented at the IAI Conference on "The International Role of the European Union and the Enlargement Process, Bologna, Spain, December 11, 2002). http://www.lse.ac.uk/Depts/intrel/pdfs/EFPU-commonforandsecuritypolicyEU.pdf. (accessed August 16, 2007).
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militarization of the EU.[131] *The Saint Malo Declaration* asserted that the European Union was the most appropriate framework for Europe to achieve three objectives simultaneously: military effectiveness, transatlantic solidarity, and a strengthening of Europe's political power.

The Treaty of Amsterdam came into force on 1 May 1999. Subsequently, frustrated with hesitant American leadership in the Kosovo crisis, motivated by a desire to give the European Union political influence commensurate with its financial and trading power,[132] and disturbed with how dependent on GPS–enabled American air power that European nations' militaries had become, in June 1999, at the Cologne EU Council, the same Council that approved the Definition Phase of Galileo, the EU leaders created the ESDP, which gave the EU the ability to organize military operations independently of the United States and NATO. For the first time, the EU Member States became collectively engaged in constructing an EU defense policy.[133] At the same time, in June 1999 EU Leaders at the Cologne Summit chose NATO Secretary-General Javier Solona for the position of High Representative for the CFSP.[134] Solana promised that he would make the European Union a more active and influential global power. It was at this time, in conjunction with the Kosovo War, that defense interest in Galileo grew considerably and "several European governments agreed that an autonomous satellite

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[131] Christopher Hill, "Superstate or Superpower? The Future of the European Union in World Politics" (London School of Economics, July 2002), 5 and 12. http://www.lse.ac.uk/Depts/intrel/pdfs/EFPU-superpowerorsuperstate.pdf. (accessed August 15, 2007).
[132] "World: Europe Agrees Military Cooperation Plan," BBC News, June 3, 1999. http://news.bbc.co.uk/2/hi/europe/359607.stm (accessed August 3, 2007).
[133] Javier Solana "EU Security and Defense Policy: The first Five Years
[134] In June 1999, Solona happened to be busily engaged in directing the Kosovo aerial campaign for NATO, so he did not take the position of High Representative in October 1999. "World: Europe Solana to Boost EU Global Power," *BBC News*, October 18, 1999, http://news.bbc.co.uk/2/hi/europe/478553.stm (accessed August 6, 2007). Also the High Representative would report once a month directly to EU foreign ministers.

navigation capability must serve as the basis for Europe's security and defense policy."[135] Likewise, it was reported that provision for the use of Galileo signals in new weapons systems was being made and specifications on how to protect Galileo's signal and infrastructure against hostile threats were being developed.[136]

As mentioned at the beginning of this section, in December 1999 the European Council set the "Headline Goal" for the creation of a 60,000 soldier strong European Rapid Reaction Force. This goal was set at the Helsinki European Council at the same time that funding for the Galileo's Definition Phase was released, and conceivably provides evidence that realist factors were significant drivers behind European decision-makers' assessments of the need for Galileo. But now that we have briefly shown the evolution of the EU's growing interest in space activities and in security matters in the 1990s, let's take a moment to assess if these trends, when combined, can be viewed as solid indicators that realist factors were the most significant drivers of the Galileo decision.

First, European space activities are embedded in a political outlook that places collective security at the center of the European construction project at home and abroad.[137] Even so, there was not a clear vision in the 1990s at the European-level or at the national level regarding the use of space for military or security purposes. Cooperation in military activities at the European-level, or even less military oriented security activities such as those called out in the Petersberg Tasks, go to the heart of

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[135] Braunschvig et al "Space Diplomacy," 159. However, Braunschvig does not provide any references or otherwise provide the basis upon which he makes this statement. I could find no comparable evidence to support this assertion.
[136] Michael A. Taverna, "Europe Launches Satnav Project," *Aviation Week & Space Technology,* 151, no. 1 (July 5, 1999): 25. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=48166370&sid=6&Fmt=3&clientld=31812&RQT=309&VName=P QD (accessed January 8, 2008).
[137] Pasco, *A European Approach to Space Security.* Xavier Pasco made this observation in this 2006 paper, however, it is also a salient point from the perspective of the 1990s.

national sovereignty issues. Reaching agreement on a military or security oriented space program, therefore, is difficult as the parties quickly confront contentious issues of differing strategic, military, and political doctrines and views, as well as financial questions.[138] Even NATO found it an exceedingly difficult process in the late 1990s to reach agreement on the topic of the next generation of NATO telecommunication satellites. Therefore, given the very immature and unclear security and military stance of the European Union in the 1990s and the fragmented views of the major European actors on the value and role of space systems for military and security uses, it would be quite remarkable if the European Union's Galileo decision in mid-1999 was primarily driven by military and security considerations, i.e. realist factors, unless the Kosovo campaign was the catalyst for such an "alarmed discovery" of European weakness by European governments that Galileo was able to quite suddenly overcome significant national, institutional, bureaucratic, and financial barriers to its militarization.[139] However, this line of argument is weakened by the fact that the EU Transportation Ministers' decision on 17 June 1999 was to accept the European Commission's recommendations from the 10 February 1999 "Galileo" Communication. Therefore, simply focusing on Kosovo ignores the fact that the Commission's February 1999 "Galileo" Communication was presented before the Kosovo conflict and ignores years of incremental progress toward the decision to build Galileo. Likewise, it is reasonable to argue that the Kosovo crisis likely acted as a "focusing event," which put an intense spotlight on European militaries' "capability gap" with the United States, especially regarding precision weapons, such that Kosovo became a powerful symbol which focused European decision-makers attention

[138] Ibid., 6.
[139] Frank R. Baumgartner and Bryan D. Jones, *Agendas and Instability in American Politics* (Chicago and London: University of Chicago Press, 1993), 87.

on the need for Galileo. However, as John Kingdon points out, focusing events and symbols in general act to reinforce something that is already taking place and do not act as the prime mover in setting the agenda. As Kingdon writes, “Symbols catch on and have important focusing effects because they capture in a nutshell some sort of reality that people already sense in a vaguer, more diffuse way.”[140] So even though several European governments may have stated that an autonomous satellite navigation capability must serve as the basis for Europe’s security and defense policy, it is reasonable to assume that security and defense factors were intervening variables, rather than the primary variables driving the Galileo decision.

The 1990s trend toward greater European Union involvement in security and defense matters reached a culmination point in 1999 at the same time the decision to approve the start of Galileo’s Definition Phase. The February 1999 “Galileo” communication does not take note of this fact however, with only a general reference made to the “strategic” questions raised by continued reliance on GPS and GLONASS. In addition, the section which deals with security considerations is concerned with how to protect Galileo from malicious disruption and how to deny Galileo signals to enemy forces in a war situation. In this regard, the communication mentions that military interfaces will be needed, implying again that none existed at the time.

Now that we have discussed the evolution of the European Union’s activities in the European space sector, and the European Union’s increasing role in military and defense matters, let’s look at some economic factors and take a closer look at some of the issues that faced ESA in the 1990s.

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[140] John W. Kingdon, *Agendas, Alternatives, and Public Policies* (New York: Addison-Wesley, 1995), 94-98.

4. Changes in the European space sector in the 1990s: The rise of commercial space, industrial consolidation, Public Private Partnerships, and ESA.

Satellite navigation services have most often been considered a public good, whether that service has been provided by military systems, such as Transit, GPS, or GLONASS, or by wished-for civilian satellite systems such as the Aerosat or NAVSAT programs. The state of the European space sector in the 1990s, however, with growing enthusiasm for the commercialization of space activities and growing optimism about the possibilities of Public Private Partnerships (PPP's), made it possible for a case to be made for a commercially profitable, civilian, global navigation satellite system. Nonetheless, the global aerospace industry experienced major transformations in the 1990s, causing concern among European leaders about the future ability of Europe's industry to compete and survive. This section describes four key trends affecting the European space sector in the 1990s: the growing profitability and significance of commercial space activities, the consolidation of the European aerospace industry, the use of PPP's as a new way for government and industry to team together to fund major space activities, and growing doubts about the effectiveness of ESA. These trends affected the evolution of the Galileo program and shaped the decision to approve the Definition Phase of Galileo in 1999.

Commercial Space: The growth of commercial space activities took off in the 1990s and helped to alleviate the loss of defense contracts after the Cold War.[141] By the end of the

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[141] Organization for Economic Cooperation and Development, *Space 2030: Exploring the Future of Space Applications* (Paris: OECD Publications, 2004), 12.

decade, government funded space activities no longer dominated the space sector.[142] By 2000 commercial space activities accounted for 65 percent of U.S. space activity and 50 percent of European space activity.[143] This trend was expected to continue and grow stronger and created an important new dynamic for decision-makers to consider when making space policy decisions. It affected decisions on which space activities should be selected to pursue and it affected decisions on how to financially structure space projects.

For the purpose of this study commercial space activities are defined as products or services which are provided by the private sector, and which are directly dependent upon a space component. Space commerce has four characteristics: private capital is at risk in development and operation; there are existing or potential non-governmental customers; market forces determine viability; and the primary responsibility and management resides with the private sector.[144] Commercial space activities may be grouped into two main categories; the upstream component (satellite manufacturers, launcher manufacturers, and launch service providers), and the downstream component, (space service providers, which may be further parsed into three main functional areas: telecommunication, remote sensing, and global navigation satellite services providers).[145]

In the 1980s, before the end of the Cold War, only telecommunication services and launch services were commercial activities and the only significant actors in commercial space activities market were the United States and Europe.[146] With the end

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[142] Pace, "Merchants and Guardians," 33. For the United States 80% of all launches in 1997 were commercial. Also Stephen B Johnson, "Space Business," in *Space Policy and Politics*, ed. Eligar Sadeh (Dordrecht, The Netherlands 2002), 280.
[143] Organization for Economic Cooperation and Development, *Space 2030*, 13.
[144] James Vedda, "Space Commerce," in *Space Policy and Politics*, ed. Eligar Sadeh (2003), 202.
[145] Organization for Economic Cooperation and Development, *Space 2030*, 13.
[146] The US commercial launch industry was only a year away from being shut down due to the decision to rely upon the space shuttle for all US access to space, the "Shuttle only" policy. The loss of the Space Shuttle Challenger in 1986 led to the scrapping of that policy.

of the Cold War, however, Russia and China entered the space launch market and soon began to compete very successfully against Europe's Ariane launcher and commercial U.S. launch services.[147] At the same time, the market for telecommunication satellites boomed and the market for commercial remote sensing satellites seemed poised to take off.[148] France led the way in commercial remote sensing when it launched the first SPOT satellite in 1986.[149] The global market for GNSS services also experienced dramatic growth throughout the 1990s as GPS became fully operational and was made available for commercial use free of charge. In the GNSS case, however, the United States had (and has) a monopoly on the market.

The separation between military space capabilities and commercial space services also began to erode rapidly in the 1990s. The booming commercial space sector posed new conceptual, organizational, and regulatory challenges due to the multi-use capabilities of commercial satellite systems, which logically had security and defense implications.[150] The three categories of commercial space actors noted above: satellite builders, space launch vehicle providers, and space service providers as well as the three functional areas: telecommunication, remote sensing, and global navigation satellite services, overlap in commercial and national security space activities. This crossover applied not only to GPS, but also to telecommunication services and remote sensing services. Naturally, the European studies and initiatives that led to Galileo took into account (as noted previously) this growth of multi-use technologies.

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[147] Stephen B Johnson, "Space Business" in *Space Policy and Politics*, ed. Eligar Sadeh (Dordrecht, The Netherlands 2002), 275.
[148] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 130.
[149] Vedda, "Space Commerce," 207. The US failed to successfully commercialize LANDSAT in the 1980s. In 1992 the Land Remote Sensing Policy Act ended the attempt to commercialize LANDSAT.
[150] Shutter control is an example of new regulatory and licensing responses to commercial remote sensing.

The boom in commercial space activities, the rise of international competition, and the growth of multi-use capabilities were not the only events reshaping the commercial space sector in the 1990s, however. The 1990s also saw the consolidation of the aerospace industry in the United States and Europe as industry restructured to adjust to the post-Cold War environment and to compete against Russia and China for business.

The United States went from more than 30 large aerospace companies in the early 1990s to just a few prime contractors by 1995. The merger of Boeing with McDonnell Douglas, and the merger of Lockheed with Martin Marietta created two mega aerospace companies, Boeing and Lockheed-Martin. Such large U.S. conglomerates gave the U.S. aerospace industry a significant economy of scale and comparative advantage in the new field of global commercial space competition. The European aerospace industry scrambled to consolidate in order to stay competitive with the United States and with emerging Russian and Chinese competition. However, the "European aerospace industry" did not really exist as such. Consolidation of the aerospace industries within individual European states occurred but could only go so far. In order to overcome the fragmentation of the European space industry and form an economy of scale and level of efficiency which could compete internationally, the nationally-based European aerospace industries had to consolidate across national borders. In doing so during the course of the 1990s, they created the consolidated European aerospace industry which today cuts across national borders in Europe.

A number of other issues arose as well. First, consolidation created concerns of its own. Significant strategic concerns arose at the national level about the ability of European states to maintain industrial capability, technological expertise, and high-tech

work forces.[151] Second, European industrial leaders were aware that, even after consolidation, the European aerospace industry could not compete against the huge American aerospace companies without European governments' financial and political support.[152] Furthermore, both the upstream and downstream components of the global aerospace industry were teaming together internationally in the 1990s. Strategic partnerships between aerospace companies and satellite service providers from different countries formed in the 1990s, as the new global aerospace market took root. In the area of commercial launch services, Sea Launch was formed creating a strategic partnership involving the U.S. giant Boeing, and Russian, Ukrainian and Norwegian interests.[153] Likewise, Lockheed-Martin formed a strategic partnership with the Russian companies Khrunichev and Energia to create International Launch Service (ILS).[154] In the commercial telecommunication satellite business arena, multi-national consortiums provided global telecommunication satellites services. In addition, remote sensing satellite companies formed regional affiliates around the world to download imagery and market their services around the world.[155]

The influence of these various issues was later reflected in the rationale for the Galileo program. The February 1999 "Galileo" communication from the EC, in the section titled: "*The economic/industrial dimension*" stated that the commercial market for GPS hardware (based on 1997 estimates) in Europe was $228.7 million and was expected to grow to $960 million by 2004 and the potential of a global market of 40 billion euros

[151] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 134.
[152] Ibid., 130.
[153] Vedda, "Space Commerce," 221.
[154] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 130.
[155] Vedda, "Space Commerce," 221.

by 2005.[156] It stated that ensuring Europe's share of the GNSS-based global market and jobs was a challenge. In addition, it recognized that Galileo would help industry stay at the leading edge of the development of applications. It also acknowledged the restructuring of the space industry in order to meet the challenges of global competition and asserted that the Galileo program would help industry meet these challenges.[157] Likewise, the 19 July 1999 Council Resolution approving Galileo's Definition Phase and accepting the February communication from the Commission immediately noted that Galileo's development would improve European's ability to compete on a large scale.[158] Undoubtedly, the trend toward greater commercialization of space activities and the consolidation of the European aerospace industry influenced decision-makers' assessments of the need for Galileo.

As noted above, the post-Cold War defense budget cuts pushed the aerospace industry to consolidate. At the same time, the impact of the aerospace industry's loss of defense contracts was mitigated by the emergence of the commercial space industry. Another significant trend that developed in the 1990s, however, was the Public Private Partnership which was a reaction to less public money flowing into space projects and more industry interest in providing capital to help start commercially viable enterprises. During the 1990s, the PPP became a popular mechanism to fund large projects and it had significant impact on the Galileo program.

Private Public Partnerships: Before the development of PPPs, the use of public funds to help establish new space enterprises was not unusual. In Europe, the development of the

[156] Commission, *Galileo,* COM (1999) 54 final, iv. Also Lembke, *The Politics of Galileo,* 8.
[157] Commission, *Galileo,* COM (1999) 54 final, 3.
[158] Council of the European Union, "Definition Phase."

Ariane rocket was publicly subsidized by ESA and especially CNES, and Arianespace was chartered as a commercial affiliate of CNES to operate the Ariane rockets. CNES even had a controlling stake in Arianespace for many years. Public funding also helped build commercial enterprises in other nations including the Russia, China and the United States. CNES developed the SPOT remote sensing satellite, creating the Spotimage affiliate in 1982 and launching the first SPOT satellite in 1986 as a public private partnership.[159] The PPP concept became more dominant in the 1990s as a means to structure partnerships between governments and businesses and as a way to justify the involvement of private actors in public works. The discussion below provides a more detailed look at the factors driving PPPs, including the quest for efficiency, commercial advantage and competitiveness.

Public Private Partnerships were important for the space sector in the 1990s. They offer advantages to governments and to businesses. PPPs offered the government the advantage of allowing private capital to play a greater role in funding government projects in which governments public funding was not possible for either political or financial reasons. Private capital also allowed larger-scale programs to be established which were beyond governments' capabilities with just public money.[160] PPPs offered businesses the opportunity to share technological and capital risks with governments and assured the purchase of future services. The private sector is sometimes not willing to unilaterally embark on the development of new, possibly profitable space ventures due to the high costs and risks associated with space and the lack of confidence that they will get

[159] Vedda, "Space Commerce," 223.
[160] Organization for Economic Cooperation and Development, *Space 2030*, 15.

a return on investment within a reasonable timeframe.[161] Therefore the private sector and the government sector often look to each other to collaborate on major projects. Public Private Partnerships provided a new means to make such collaboration successful, and the Galileo project's combination of providing a public good, as well as the potential for commercial profitability, made Galileo appear to be a suitable project to structure as a PPP.[162]

The British became the biggest advocates of the PPP concept in the 1990s and applied the concept to a broad range of public programs, not just space projects. In the 1980s, the ideology of the British government under Prime Minister Thatcher was financially such that the British government was very reluctant to back big programs. The British confidence in PPPs was illustrated by a multi-lateral telecommunication satellite project that was underway in the 1990s, concurrent with the development of the concepts for Galileo. The British were negotiating with the French and Germans to jointly develop a new military telecommunications satellite called Trimilsatcom.[163] Ultimately the British unilaterally withdrew from the program because the British wanted to use a version of a PPP called a Public Private Initiative (PPI) to finance Britain's own military communications satellite, which the British eventually developed into the Skynet 5 satellite program.[164] In this case, private interests financed, built, own and operate Skynet 5 satellites, with the military simply purchasing the communication capacity it needs for the military mission. Any excess bandwidth is leased to private users. In this

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[161] At the time of the Organization for Economic Cooperation and Development, *Space 2030* report, seven space projects had been started under PPPs, six of which are in Europe. Galileo is the biggest. Organization for Economic Cooperation and Development, *Space 2030, 15.*

[162] Commission, *Galileo*, COM (1999) 54 final, 17.

[163] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 138.

[164] The Public Private Initiative (PPI) is structured differently than a PPP, but the general idea of using private and public funding for public projects is similar.

way, the British government got the military capability it needed, but without the expense of owning and operating a purely military system, and the private interests get a guaranteed return on their investment from the long-term military contracts.

The French, Germans, and EC also showed interest in PPPs. In 1996, CNES placed the PPP concept in the center of its space policy planning, with the expectation that PPPs would improve efficiency and save program costs. French industry viewed PPPs as a means to reduce government intervention and to allow industry to be treated as equal partners with CNES in decision-making.[165] Nevertheless, France initially opposed making Galileo a PPP.[166] In 1997 the Germans also officially looked toward the PPP concept as a reasonable guide for linking government, industry, and science more closely, and for getting industry to co-fund commercially viable programs.[167] Likewise, the 1997 EC Communication on PPPs, endorsed by the European Council and European Parliament, recommended that the PPP approach become a priority for the EU.[168] It was in this milieu of growing enthusiasm for PPPs that the Galileo program was conceptualized and there is speculation that the British would have never agreed to the Galileo program in 1999 if it was not structured as a PPP.[169]

The trend toward PPP's culminated for our purposes in the February 1999 "Galileo" communication from the Commission which proposed a combination of public financing, revenue streams, and a PPP, to finance the Galileo program, in recognition of

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[165] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 148.
[166] Lembke, *The Politics of Galileo*, 10.
[167] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 139. Suzuki cites the 1996 CNES *Plan Strategique du CNES;* as well as the 1997 German Federal Strategic Paper, *Space: Prospects for Research and Applications.* I attempted to review these primary sources directly but was unsuccessful.
[168] EC COM (97) 453 final 10 September 1997.
[169] Giulio Barbolani di Montanto, ESA official, interviewed by author, Brussels, BE, December 7, 2007. Barbolani di Montanto, also speculated that the British were stunned when France and Germany agreed to structuring Galileo as a PPP. His opinion is that the British never expected that the French and Germans would agree to a PPP.

the fact that Galileo's multi-use capabilities combined public service and commercial aspects. The Communication said the ideal approach would be to set up a PPP as soon as possible, but significant questions remained on how it could be set up with regard to appropriate distribution of roles and tasks, ensuring optimal competition, and creating appropriate management structures. These questions were never adequately resolved during the time period of this study, and this created a nearly fatal obstacle to the Galileo project. Nevertheless, Galileo was approved as the first major space program to be financed through a Public Private Partnership.[170]

The European Space Agency was one actor for which the concept of Public Private Partnerships was difficult to incorporate, however. As a matter of fact, the trends noted above: declining public budgets for space activities, the consolidation of the European aerospace industry at the European-level, the rise of global commercial competition in space, increased EC interest in the European space sector, rising interest in using space applications to address security concerns, along with the growing enthusiasm for PPP mechanisms, presented a glut of problems for ESA in the 1990s. The ESA funding mechanism of *juste retour* was at the root of some of these problems. In addition, ESA's mandate to only engage in those activities which were purely for "peaceful purposes" prevented it from considering projects directly connected to military capabilities.[171] ESA's relatively weak political ability to develop, implement and enforce a comprehensive European Space Policy was also a problem, (discussed earlier). The discussion below briefly describes the problems which faced ESA in the 1990s and which affected the decision to give the EC the lead role in the Galileo project.

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[170] Bildt and Dillon, "Europe's Final Frontier," 10.
[171] Madders, *A New Force at a New Frontier,* 185.

The European Space Agency: In the 1980s the European Space Agency established a reputation as a world class organization which delivered good results. However, in the 1990s, ESA's ability to adjust to the new environment after the Cold War was an issue. First, in early the 1990s ESA program cost overruns, especially in the development of manned space flight capabilities, dissatisfied European decision-makers and a round of budget tightening ensued.[172] The ESA Member States demanded that ESA become more efficient and provide better management.[173] The ESA mandatory budget for science was frozen in 1996 and ESA Member States insisted that ESA cut 12 percent of its employees by 1998. Second, money for ESA optional programs, which came from its Member States' discretionary budgets, also became tight due to recession and fiscal tightening measures required for countries to join the European Monetary Union.

Germany, with the burden of paying for German re-unification, reduced its budget for space activities and became less enthusiastic about manned space flight.[174] In addition, CNES, DLR, and ASI began to consider ESA decision-making processes as a hindrance to achieving their national goals and viewed the ESA budget as taking away from their own budgets.[175] While dissatisfaction with ESA management grew, and public funding of space activities eroded in the 1990s, ESA also faced difficulties caused by the restructuring of the aerospace industry and the rise of the global commercial space sector.

[172] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 124. Madders, *A New Force at a New Frontier*, 325.
[173] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 127.
[174] Madders, *A New Force at a New Frontier*, 314 and 320. Also, Ralf Huber, national expert to EC Space Policy Unit, stated in September 2007 interview that up until 1998 Germany had provided the majority of the funding for Europe's participation in the International Space Station (ISS). However, the government of Chancellor Gerhard Schroeder perceived human space flight activities as an inefficient use of resources and looked for a way to get out of human space flight. Germany pushed for greater EC involvement in space applications and services for users as one way to get out of human space flight.
[175] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 140.

The ESA practice, and one of the foundations of its success, the principle of *juste retour*, created two problems. First, the consolidation of the European aerospace industry at the European-level appeared incongruous with the concept of national aerospace industries and the practice of promoting and protecting industrial "national champions." The principal of *juste retour* pulls in the opposite direction of European-level industrial consolidation and the creation of international commercial space partnerships. Therefore, ESA was seen as inhibiting European efforts to achieve sufficient economies of scale to compete successfully in the global commercial space marketplace.[176] In addition, since ESA contracts were based upon *juste retour*, rather than basing them upon efficiency and cost effectiveness, it was perceived as an inefficient means for spending scarce resources, which also harmed international competitiveness.[177] Many advocated for the revision of the *juste retour* system and Germany and the United Kingdom called for its abandonment.[178] In addition, ESA programs in general were not focused on satisfying user-oriented commercial needs.[179] These aspects of ESA frustrated European decision-makers and in March 1998, CNES, DLR and ASI issued a position paper calling for ESA reform.[180] The EC was suggested as a possible alternative institution through which cooperative European space activities could be accomplished more rationally and more

[176] Eurospace, "Space: a Challenge for Europe." *Space Policy* 11 (1995): 227. Lembke, *The Politics of Galileo*, 230.

[177] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 131.

[178] Alain Dupas and others, "A Franco-German View of Europe's Ambition in Space for the 21st Century." *Space Policy* 17 (2001): 106. and Suzuki, *Policy Logics and Institutions of European Space Collaboration*, The juste retour policy was so embedded in the institutions of European space collaboration, however, that to this day, the policy has not been changed significantly.

[179] Pasco and Jourdain, 330.

[180] Dupas and others, "A Franco-German View," 106.

efficiently. However, ESA proved to be a very "sticky" organization and eventually began to adjust to the new environment in the European space sector.[181]

Perhaps unsurprisingly, ESA's role is clearly secondary to the Commission's role in the February 1999 "Galileo" Communication. ESA is mentioned with regard to the GNSS studies it conducted, as an agency with which there could be some synergy for cooperation, as a source of public funding for Galileo, as a source of technical expertise, and as a member of the proposed Galileo program management board. Nevertheless, given that ESA was the premier actor in the European space sector, you would think it would be mentioned more than once in passing in the four page Executive Summary, and only a half a dozen times in the remaining thirty pages of the EC Communication.

Up to this point, this chapter has described a broad range of factors which influenced European decision-maker's assessment of the need for Galileo including: the growing importance of satellite navigation as embodied by GPS, the development of the EU's growing interest in space and security issues, the evolution of the commercial space sector and industrial issues, and the issues with ESA. These trends affected the evolution of the Galileo program and shaped the decision to approve the definition phase of Galileo in 1999, and they begin to answer the questions of what actors and factors caused European decision-makers to decide that Europe must have an autonomous navigation satellite system and why the EC was given the lead role in the Galileo program. The section below narrows the focus by giving brief overviews of French, German, Italian and British national priorities up to the 1990s, especially regarding security, space, and industrial issues.

[181] For an explanation of the "stickiness" of internantional organizations see G. John Ikenberry, "Institutions, Strategic Restraint, and the Persistence of American Postwar Order," *International Security*, 23, no. 3 (Winter, 1998-1999): 45.

5. Space, Security, and Industrial trends in France, Germany, Italy, and the United Kingdom:

In order to comprehend as many factors as possible which affected European decision-makers' decision to approve the Galileo program, it is crucial to appreciate what was motivating decision-makers at the national level. This section narrows the focus to what motivated France, Germany, Italy, and the United Kingdom during the 1990s, while taking into account the historic context in which these motivations arose. National level concerns over autonomy, cooperation with the United States, the "technology gap," and the "brain drain" were significant justifications for European space activities in the 1960s and continued to be raised in the 1990s in relation to Galileo. These concerns are discussed below from French, German, Italian, and British points of view. Political, industrial, and military perspectives on the use of space for each country are reviewed.

This section begins with France and Germany since they are historically the main advocates of a strong European space effort, provide two thirds of Europe's overall space budget and underpin the development of Europe's major space capabilities.[182] French and German collaboration made ESA possible and they are credited with giving Europe a major presence in space.

France: Since France is well known for its strategic thinking and concern for autonomy it seems reasonable to assume that compared to any of the other European states examined in this study we'll find that realist factors weighed heavily in French decision-makers' assessment of the need for Galileo in 1999. However, a close examination reveals that

[182] Dupas and others, "A Franco-German View," 103.

such an assessment is not so easy to make, and liberal and ideational factors also carried significant weight.

In 1965 France became the third country to demonstrate an independent capability to access space when it used a French launch vehicle to launch a French satellite.[183] In order to appreciate a large part of the impetus behind this French space program it must be placed in its historical context, necessarily beginning with French President Charles de Gaulle. In the late 1950s and 1960s De Gaulle pledged to restore France's national prestige by making France independent militarily and economically, as opposed to relying upon NATO and the United States. The French space program addressed all of these concerns. First, possessing space capabilities garnered tremendous international prestige. Second, space technology was considered a future enabler of France's strategic military autonomy. The development of the French strategic nuclear force or *force de frappe* in the 1960s required the future development of autonomous satellite support systems for strategic communications, surveillance, targeting, and meteorology.[184] Third, space technology played a key role in economic development. The reasoning was that space technology spurs broader scientific and technological development, which leads to greater overall industrial development, which in turn, leads to stronger economic development.[185] In short, De Gaulle saw that the means for France to gain economic and military autonomy was through technological development and the narrowing of the

[183] Ibid., 104.
[184] Walter McDougall, "Space-Age Europe: Gaulism, Euro-Gaulism, and the American Dilemma," *Technology and Culture* 26, no. 2 (1985): 181. http://www.jstor.org.proxygw.wrlc.org/stable/3104340 (accessed November 16, 2007). Satellite navigation is not mentioned in this source from 1985, once again driving home the point that the importance of PNT, as demonstrated by GPS, developed unexpectedly. Also see Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 109.
[185] Johnson-Freese, *Space as a Strategic Asset*, 9. Today these industrial, economic benefits remain, however, rather than industrialization, advanced economies today rely upon knowledge and information, which make space technology even more significant in spurring broader economic growth since space application satellites enable the global information infrastructure and information-based economy.

"technology gap" between Europe and the United States (as well as the Soviet Union).[186] Although the French strategy was to have a "presence" in every high technology field including nuclear, aeronautic, and electronic fields,[187] the most central task in this effort became the development of space technology.[188] Space technology was considered vital as a means to help close the technology gap between the United States and Europe and help stem the "brain drain." Eventually the French emphasis on technological development became so pervasive that French identity became strongly connected with French technological skill.

The French space agency CNES, the world's second civil space agency, was founded in this atmosphere in 1962 and industrial policy was the foundation of its activities. As such, ever since CNES' main purpose has been to promote and increase French industrial capacity and international competitiveness.[189] CNES' economic goals, and the prestige that CNES pursued, eventually overtook French military interest in space technology.[190] As a matter of fact, the French Ministry of Defense has never considered space a very high priority[191] and as noted in Chapter 2, the French military views military space capabilities as a "support" function.

It is understandable then that the development of military space capabilities never took priority over any other French armament program and that there is no dedicated budget line for French military space activities. Nonetheless, France developed military communication and observation satellites by the 1990s (Syracuse and Helios

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[186] McDougall, "Space-Age Europe." 181.
[187] Pasco and Jourdain, 322.
[188] McDougall, *The Heavens and the Earth*, 424.
[189] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 148.
[190] Madders, *A New Force at a New Frontier*, 82.
[191] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 109.

respectively) and conducted research into other types of military space capabilities. However, even today these military space capabilities are meant mainly for the strategic use of top-level French decision-makers and are not integrated well into the operational or tactical use of French military forces.[192] So, although greater resources have been spent in France on military space relative to the rest of Europe, France has maintained low military expenditure levels for military space projects.[193]

Nevertheless, French decision-makers consistently supported a strong French space policy, primarily to insure independent decision-making and to resist domination by the United States in military and technological capability.[194] This effort made France the leading space power in Europe and the European power that thinks the most strategically about space issues. However, in the mid-1990s spending on the French space program began to face criticism from other parts of the French government as the economy suffered a downturn and the challenge of meeting the Maastricht convergence criteria led to tough government spending reviews and a leveling off of French space program budgets.[195] Financial concerns, especially with regard to French participation in manned space programs, began to out-prioritize autonomy concerns in the French space program.[196]

At the same time, in a reprise of the technology gap concerns of the 1960s, European leaders in the 1990s feared a growing technological gap between Europe and the United States. Several European analysts warned that Europe's future economic

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192 Lt Col. Christophe Morand, interviewed by author, Paris September 20, 2007.
193 Pasco, *A European Approach to Space Security.*
194 Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 146. Madders, *A New Force at a New Frontier*, 485.
195 Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 159.
196 Dupas and others, "A Franco-German View," 108. Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 127.

prosperity, and therefore its autonomy, were threatened by U.S. military and commercial technological superiority.[197] They perceived that the United States was gaining global market share by adapting its military technological superiority to commercial superiority – with GPS being an obvious example. France acknowledged that it did not have the economy of scale to compete in large scale, information age, high technology program development, including armaments programs. Modern arms, especially in the aerospace sector, were just too expensive for France to develop by itself. France accepted the notion that in order to survive and compete, its aerospace industry and armaments industry would have to consolidate at the European-level and that France would have to increase participation in cooperative European high technology programs.[198] In addition, given that France and Germany, even when working together, could not compete head-to-head with the United States on the development of high technology military capabilities, they chose to compete by strengthening their economic competitiveness, especially in high technology sectors such as aerospace, in order to "asymmetrically balance against American hegemony."[199] Around this time, the French were also beginning to recognize the cost effectiveness and political value that dual-use capabilities could offer in the post-Cold War setting. The proposed Galileo program addressed all of these concerns nicely, and Galileo was to be one of the most important tools in this effort, along with the Airbus project.[200] Interestingly, all the above factors just noted have "zero-sum" economic overtones, i.e. realist connotations, about them.

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197 Lungu, "Power, Techno-Economics, and Transatlantic Relations," 30.
198 Lungu, "Power, Techno-Economics, and Transatlantic Relations," 21. Johnson-Freese, *Space as a Strategic Asset*, 169.
199 Lungu, "Power, Techno-Economics, and Transatlantic Relations," 22.
200 Ibid., 36.

Unsurprisingly then, the French government regarded Galileo as having primarily political and strategic purposes.[201] Given the multi-use nature of Galileo, the French government also promoted the interpretation of "security" for Galileo as including military security. But, in fact, no French military agency said that they wanted to subscribe to Galileo. Indeed, due to budget constraints and the availability and reliability of GPS, the French Ministry of Defense categorically refused to financially support Galileo.[202] Despite all the rhetoric and emphasis on French, and later, European "autonomy," and the strategic importance of an autonomous European navigation satellite capability, this study found no French military or defense establishment requirements to build Galileo.[203]

Throughout the space age France has considered technology the best means for ensuring its autonomy, with space technology taking a privileged position in this endeavor. Galileo fits well within this paradigm - with strategic political and economic considerations intertwined with military and security considerations. This makes it exceedingly difficult to measure the relative weight of these considerations, but given the emphasis on technological, industrial and economic development versus the French military and defense establishment's relative lack of interest and lack of direct, overt support for Galileo, and given the strong civil nature of CNES as well as the European-level cooperative aspects of the Galileo program, it is reasonable to assess that liberal factors may have weighed more heavily than realist factors in French decision-makers'

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[201] Lembke, *The Politics of Galileo*, 11. Lungu, "Power, Techno-Economics, and Transatlantic Relations," 13.

[202] French MoD official, quoted in Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 195.

[203] Johan Lembke, "EU Critical Infrastructure and Security Policy: Capabilities, Strategies and Vulnerabilities," in *European Economic and Political Issues* 6 ed. Frank Columbus (Hauppauge, NY: Nova Sciences, 2002), 67.

assessments of the need for Galileo. Well-known French political leadership concerns for autonomy may lead observers to assume the that realist factors weighed most heavily, but based upon this study's requirements for more concrete indicators, that assessment cannot confidently be made.

Germany: Germany is the second largest space power in Europe, but its space program was shaped by different constraints, interests and priorities so that its goals are significantly different from the French space program. Germany's interests and goals for Galileo were shaped more by industrial and economic interests than France, and much less by strategic political and military considerations. Even so, in the 1990s Germany also recognized the necessity of consolidating its aerospace interests at the European-level in order to achieve the economy of scale to compete with the United States in the global market.

Germany developed a relatively robust national space program in the 1970s and 1980s but German space policy was never a very prominent issue and it was most often subordinated to technology and foreign policy.[204] Germany focused mainly on scientific research, technological development and on cooperative efforts with both NASA and ESA.[205] In fact, since the majority of Germany's space effort was managed through ESA, the German space program was never very strong institutionally within the German government. Even so, Germany, like France, viewed space technology as an important stimulus for its technological and industrial development. However, Germany was not motivated as much by concerns about autonomy and prestige. Germany viewed

[204] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 164.
[205] Madders, *A New Force at a New Frontier*, 491.

collaborative efforts as the best way to gain technology and expertise which could benefit the German economy.

In the 1990s, due to the severe economic constraints imposed by German reunification, slow economic growth, and the Maastricht criteria, Germany cut back its spending on space activities and defense. Some observers in the 1990s surmised that Germany would not be able to participate in new, large, international or European space programs for some time.[206] Germany also prioritized efficiency and cost effectiveness so highly that it, along with the United Kingdom, called for ESA's *juste retour* policy to be scrapped. Therefore, Galileo's projected economic benefits including: its potential to stimulate the German (or European-level based in Germany) aerospace industry; its potential to generate profits through the marketing of its services; its importance to other sectors of the economy; and the co-funding it could receive from commercial interests in a PPP arrangement were key considerations of German decision-makers when they considered the Galileo program. As noted above, however, Germany and France decided in the 1990s that strengthening their economic competitiveness, especially in high technology sectors such as aerospace, was required for the asymmetric balancing of American hegemony. Such an "internal balancing" perspective makes it difficult to distinguish between realist and liberal factors, making it necessary to further weigh German motivations by looking at their defense establishment's perspective on Galileo's capabilities.

While Germany developed a solid space program based upon scientific, technological, and commercial considerations in the Cold War, there was little interest in Germany for military space activities. In fact, France spent about ten times more on

[206] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 164.

military space than Germany and Germany did not support the French effort to develop and operate a space reconnaissance system based upon optical observations.[207] The Cold War inhibited Germany from developing an interest in military space activities. In short, Germany relied upon NATO for its military security, so there was no requirement for Germany to develop its own military space capabilities. In addition, the German military was structured to defend German territory from invasion by the Warsaw Pact. Since the German military was not concerned with "out of area" force projection capabilities, space systems were not required to provide the German military with strategic communications, reconnaissance, or navigation capabilities.[208] The result was that Germany did not develop its own military space capabilities until after the turn of the century. In the 1990s the Germans began to show interest in developing military space reconnaissance capabilities for Conventional Forces in Europe (CFE) treaty verification purposes – not operational military use, but they preferred that any system should be constructed at the European-level,[209] or in cooperation with France. Furthermore, they were wary of placing much faith in 'exotic technology,' and even if they wanted to, they couldn't afford it anyway.[210] In addition, during the 1990s Germany's top strategic priorities were restructuring the unified Germany and bringing Eastern and Central Europe into NATO and the EU. These major strategic endeavors left scant money and no energy for the modernization of German military capabilities. In sum, the German Ministry of Defense focused heavily on strategic priorities in the 1990s, rather than on military capabilities,

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[207] Dupas and others, "A Franco-German View," 106. Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 109.
[208] Lungu, "Power, Techno-Economics, and Transatlantic Relations," 28.
[209] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 163.
[210] Lungu, "Power, Techno-Economics, and Transatlantic Relations," 23.

making it unsurprising that the German military did not have a significant stake in the development of Galileo.

Furthermore, the German and United Kingdom governments, as well as others, strongly opposed the idea of Galileo for military purposes, since that would jeopardize business investment.[211] The Germans were concerned that if Galileo was not perceived as a purely civil program, it would more likely be targeted and disrupted in some future conflict. The German's feared that such a threat could create the impression that Galileo wouldn't be any more reliable than GPS, which would undermine the business case for Galileo, potentially making investors and future subscribers reluctant to buy into the system.

Given these considerations it is difficult conclude that realist factors, especially concern for military capabilities or zero sum economic gains weighed more than liberal, factors in German leader's assessments of the need for Galileo.

Italy: The strength of Italy's space program is often overlooked despite the fact that Italy was involved in space activities at the beginning of the space age, becoming the third country with a satellite in space in 1964.[212] From the beginning Italy's preference has been for close cooperation with NASA and heavy involvement in European space collaborative efforts. As a result, Italy achieved the status as the third national space power in Europe behind France and Germany, and became the third largest contributor to ESA. Similar to the German case, Italy managed a large part of its space program through ESA, with ESA acting, in effect, as "a bank, project manager, and cost-sharing

[211] Lembke, *The Politics of Galileo*, 10. Other governments include the Netherlands and Sweden.
[212] Madders, *A New Force at a New Frontier*, 87 and 493. The San Marco 1 satellite was launched on a NASA Scout launch vehicle on December 25, 1964.

partner for Italy."[213] Understandably, ASI was organizationally weak and it was not until 1997 that Italy produced its first national space strategic plan.

Italian perspectives on space had more in common with the German space program than the French space program for many years. On one hand, the scope of Italy's space program covered a broad range of capabilities, like the French space program, but on the other hand, space in Italy was not considered as high a national priority as in France. Like Germany, Italy focused its space efforts on scientific and technological progress, economic development, and international cooperation, rather than on strategic political and military issues. Likewise, Italy showed little interest in developing space capabilities for military purposes and did not launch its first dedicated military satellite, the Sicral I telecommunications satellite, until 2001.[214] However, they have participated bi-laterally since the 1990s in the French military Helios earth observation satellite program and began to participate in other European bi-lateral and multi-lateral security space projects since 2000.

In the 1990s the Italian perspective began to change, however. The 1997 Italian space strategic plan, in addition to calling for strengthened partnerships with industry[215] (in a nod to the popularity of PPP), argued that the Italian national space program should be given more weight relative to Italian participation in ESA, and that ASI should engage in more bilateral cooperation, especially with France. On Galileo, Italy shared the French perspective that Galileo's political and strategic purpose outweighed the importance of

[213] Stephen B Johnson, "Space Business" in *Space Policy and Politics*, 303.
[214] Theresa Hitchens and Tomas Valasek, *European Military Space Capabilities: A Primer* (Washington: Center for Defense Information, 2006), 34.
[215] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 141.

the commercial profit motive. Today Italy and France work closely together on space issues, including Galileo.

United Kingdom: The United Kingdom is the fourth largest contributor to ESA, but at a level much less than the France, Germany and Italy. The United Kingdom prioritizes its space efforts on commercial marketability and on providing services to British citizens to improve their quality of life in the most cost effective manner possible, which includes cooperation with ESA and the United States. The United Kingdom is so devoted to cost effectiveness that it advocated for the abandonment of *juste retour* in ESA in the 1990s. In addition, issues of autonomy and the development of high technology are of much less interest than in France. With regard to Galileo, even though it was skeptical of Galileo's commercial viability, the British insisted that it be funded as a PPP and that it not be used for military purposes.[216]

Most British military requirements for space capabilities are met through its close relationship with the United States. The British depend on the United States to equip their military with leading edge space capabilities and the United Kingdom is given access to U.S. satellite data that the United States does not share with other countries.[217] Thus, the U.K. has little need or will to develop its own national level security space programs. In the 1990s the British military was satisfied with GPS and did not see a need for Galileo. Likewise, since GPS was freely available, British leaders did not consider it cost effective to contribute billions of pounds to duplicate a capability that it had already.

[216] Britain is skeptical about the European Union in general, and always reluctant to granting the EU a bigger role, so it seems reasonable to assume that the United Kingdom would also be skeptical of Galileo.
[217] *UK Space Strategy: 2003-2006*, 15.

The United Kingdom has also purposefully avoided "national prestige" space activities.[218] It focused on the use of space systems which promised commercial benefits, excellence in science, and expanded the application of space-based services throughout the economy. The British negative feelings toward national prestige programs applied to British attitudes toward ESA and European Commission space activities as well, including Galileo. In addition, one of the arguments for the creation of a comprehensive European space programs is the support this will give to the development of a European identity. Prestigious European-level space projects such as Galileo will theoretically help solidify this identity. Given the United Kingdom's traditional reluctance about the entire European Union, perhaps their reluctance in this regard is not surprising. First, the benefits of national prestige programs are oftentimes intangible. Second, perhaps the United Kingdom doesn't want to help create a European identity.

The only security space programs the United Kingdom currently has are the aging Skynet 4 and the new Skynet 5 telecommunication satellites. As noted previously, the Skynet 5 system was structured as a PPI and is owned, developed, launched, operated, and maintained, all the way down to the tactical terminal level, by Paradigm, an EADS Space Company. The U.K. Ministry of Defense signed a service contract with Paradigm to provide the military with these end-to-end Skynet 5 telecommunication services.[219] This picture of a fully civilian business owning and operating large-scale, critical defense infrastructure illustrates the distinctiveness of the entire British approach to space and

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[218] Alan Cooper, "Space for Science, Enterprise and Environment: the UK Draft Space Strategy," *Space Policy* 19 (2003): 262. This policy can be traced back to the 1960s and the United Kingdom's lack of support for Ariane 5. Non-participation in the International Space Station also exemplifies this position.
[219] "*Paradigm Awarded Skynet 5 Contract*, Paradigm. http://www.paradigmsecure.com/?OBH=30&ID=27 accessed (February 23, 2008).

makes it difficult to argue that realist factors are a primary motive for British interests in Galileo.

In summary, France, Germany, Italy and the United Kingdom each saw Galileo within the unique context of its own history, interests, goals and priorities. However, it seems reasonable to argue that scientific, technological and commercial interest, as well as interests in using space as a means to international cooperation, outweighed military and defense interests in French, German, Italian, and British decision-maker' assessments of the desirability of Galileo. The French stated the most realist leaning rationales, using zero-sum economic arguments more so than military arguments, however. But French, German, Italian, and British militaries and defense establishments did not make a significant push for autonomous military satellite capabilities in general and defense planners showed little interest in underwriting Galileo development.[220] Nor did they see the need for Galileo to enable their precision weapons capabilities. As a matter of fact, although France and Britain, the two most militarily capable European states, now emphasize the need for more precision strike capabilities in their defense planning documents, they are planning to use GPS to guide their munitions, even munitions which are made in Europe.[221]

6. Findings:

In order to test the study's three hypotheses, the indicators outlined in Chapter Three are used with special emphasis given to indicators which show the defense, civil, or

[220] Taverna, "Europe Launches Satnav Project."
[221] Valasek, "Galileo's 'Strategic' Role," 40.

commercial nature of organizations deeply involved in initiating and managing the project; the defense, civil, or commercial sources of money for the project, and the defense, civil, or commercial nature of those with the most control over the project.

Hypothesis A: Realist factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.

I reject Hypothesis A due to the lack of convincing realist indicators at the time of the 1999 decision. The evidence-based method used here did not uncover solid evidence that Galileo's civil and commercial "image" really was "carefully crafted" for reasons of political sensitivity surrounding the European Union's emerging military security concerns.[222]

First, based upon the many threads we traced above, the insignificant amount of any national level or European level military or defense involvement organizationally, or financially, in the Galileo program makes it very difficult to argue convincingly that realist factors weighed the most. On the contrary, as noted in the interim analysis above, the Galileo program was initiated and managed by civil European international organizations with no legal, bureaucratic, or traditional authority to delve into military and defense issues or geo-political power issues. In addition, in a few interesting parallel

[222] Valasek, "Galileo's 'Strategic' Role," 38. Also Sorin Lungru asserts that European decision-makers made a conscientious and deliberate effort to promote and legitimize GNSS as a purely civilian project, with the preferences of the European defense ministries and military agencies remaining largely hidden from the public debate. However, I find his evidence unconvincing due to an incorrect definition of 'economic security' in European usage, as defined in Chapter Three; and especially due to failure to distinguish between military inputs on how to detect and react to malicious interference and protect Galileo's navigation signals, with actual military design specifications proactively driving system design requirements. Due to these two major oversights Lungu gives too much weight to the influence of military and security considerations. Lungu, "Power, Techno-Economics, and Transatlantic Relations," 13.

arenas, a RAND study published in 1997 noted that: 1) "it was striking how European militaries were not part of civil aviation coordination processes"; 2) There was a wide chasm between the civil and military GPS communities in Europe; and 3) there was almost a willful inattention to international security issues in European civil organizations.[223] Likewise, there was very little (if any) coordination of defense R&D spending and procurement at the supranational level in the EU. In fact, EU Member State's defense policies paid little or no regard to a common EU defense policy.[224] It is doubtful that the Galileo program was able to overcome these various organizational obstacles and suddenly spark an entirely new level of tight civil/military dialogue and coordination in Europe.

Financially, given the self interested nature of bureaucratic politics,[225] it seems farfetched to assume that Transportation and Research Ministers guiding the European Commission and ESA, respectively, would be so gullible as to allow funding from their budget lines to be diverted to military security and defense activities in order to maintain Galileo's "image" as a commercial and civil enterprise, without protest, or at least some quid pro quo, or demanding some major contributions from military or defense pots of money. Setting up the Galileo Definition Phase, and the longer term program, to draw upon European Union Trans-European Networks funds, research funds, and ESA funds, as well as structuring the enterprise to rely heavily upon PPP financing, while conspiring to obscure "free-riding" realist power motives, seems a bit implausible, especially given the diverse number of civil organizations involved.

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[223] Pace et al., *The Global Positioning System*, 40.
[224] Lungu, "Power, Techno-Economics, and Transatlantic Relations," 33.
[225] James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York: Basic Books, 1989), 28. Graham T. Allison, Essence of Decision: Explaining the Cuban Missile Crisis, 1st ed. (Boston: Little, Brown, and Company, 1971).

Second, there was also a lack of military or defense ministry control found in system design requirements or influence in the decision-making processes. The evidence also shows that in 1999 European militaries and defense establishments did not ask for Galileo's capabilities, although there was some initial consideration of using Galileo in armaments, especially among the French.[226] On the contrary, as shown above, European militaries did not want to spend the money on Galileo, since GPS met their needs. European militaries did not ask for Galileo and had no requirement for it.[227] In addition, consideration of physical, information, and personnel security in the Galileo program was taken in 1999, but was minimal, and little funding was being turned towards such considerations and no institutional structures were in development to deal with such issues.[228] While the 1999 Kosovo campaign may have shocked Europe and opened a "policy window"[229] that made the decision possible, the evidence suggests this was an intervening variable and not the primary cause of the decision to approve start of the Definition Phase of Galileo.

Third, international participation was desired in the Galileo program as a means to spread the costs, improve efficiency, and as a diplomatic tool to promote cooperation which could spillover into other arenas. The European Commission sought financial participation from Russia and Japan as well as many other countries. Cooperation with

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[226] Taverna, "Europe Launches Satnav Project." Lembke, *The Politics of Galileo,* 30.
[227] Lembke, "EU Critical Infrastructure," 67.
[228] In 1999 and 2000, the Civil Military Interface Study and the GNSS Forum for Security and Defense Considerations provided initial studies regarding Galileo security and defense considerations. L. Tytgat, J.I.R. Owen and P. Campagne, "Development of a Civil Military Interface in Europe for Galileo," *Journal of Navigation* 53 (2000): 273-278. http://journals.cambridge.org.proxygw.wrlc.org/download.php?file=%2FNAV%2FNAV53_02%2FS037346330000884Xa.pdf&code=310b14a19c4ece0af111c69b82140018 (accessed January 8, 2008).
[229] Kingdon, *Agendas, Alternatives, and Public Policies*, and Michael D. Cohen, James D. March and Johan P. Olsen, "A Garbage Can Model of Organization Choice," *Administrative Sciences Quarterly* 17, no. 1 (March, 1972): 1-25.

the United States was sought in order to prevent disagreement and maximize the capabilities of the GNSS at the lowest cost. This makes it difficult to argue that the Europeans desired cooperation in order to balance the United States. It appears more plausible that European leaders desired cooperation with the United States out of concern for absolute gains rather than relative gains. Indicators which signal “realist” zero sum economic motives and relative gains rationales are easier to find than military and defense indicators, especially in the French position, but they don’t appear to outweigh the liberal economic indicators, discussed below.

Finally, although there was significant rhetoric at the start of the Galileo program about autonomy, independence, “strategic” issues, and “security” implications, these words are not, in and of themselves, solid enough indicators of realist motives to outweigh many more concrete liberal indicators. In sum, there is not sufficient concrete evidence to conclude that realist factors weighed the most heavily on European decision-makers’ assessments of the need for Galileo. Realist factors were most likely intervening variables which affected the decision-makers assessments, but did not weigh the most.

Hypothesis B: Liberal factors weighed the most heavily on European decision-makers’ assessments of the need for Galileo.

I do **not** reject Hypothesis B. This study found many solid indicators that liberal factors carried the most significant weight at the time of the 1999 decision. This study found that civil or commercially oriented organizations were deeply involved in initiating and

managing the project; funding for Galileo came from civil or commercially oriented sources; and civil or commercial officials had significant control over the project.

In addition, Germany and the United Kingdom took the position that Galileo was for commercial and civil purposes and the military should have no role in the program. In a manner consistent with their broader view of space activities and space applications, German and the British decision-makers staunchly focused on the market potential and jobs which Galileo could bring and thought military uses of Galileo would make the program less commercially successful. France and Italy, on the other hand, emphasized strategic and political purposes, but more in the sense of technological and industrial autonomy rather than geo-political concerns over military balancing, security dilemma concerns, and military security concerns. Nevertheless, it is doubtful that French decision-makers could have misled the British and Germans and others in a ruse to get their approval for Galileo and go against their stated interests.

In addition, international participation beyond Europe was sought for Galileo in order to spread the costs, make the system more efficient, provide a global public good, and to be mutually beneficial.[230] It does not appear as if international participation was sought in order to create alliances to balance American military power. Otherwise, why did the EU intensify contacts with the United States in 1998 in order to assess the potential for joint development of a civil GNSS system, and why recommend in 1999 that Galileo should be interoperable with GPS?

In sum, there is both sufficient concrete evidence and logic to conclude that liberal factors most likely weighed the most heavily on European decision-makers' assessments of the need for Galileo.

[230] Commission, *Galileo,* COM (1999) 54 final, 2.

Hypothesis C: Ideational factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.

I reject Hypothesis C due to a lack of convincing ideational indicators at the time of the 1999 decision. In order to disentangle the ideational perspective from the liberal and realist perspectives, this study sets aside ideas related to liberalism and realism, such as (respectively) beliefs concerning liberal open markets, trade, and institutions; and beliefs concerning power, autonomy, and independence. If ideational factors were driving European decision-makers assessments of the need for Galileo in 1999, this study should find that identity considerations, especially ideas about European cohesiveness, pride, and prestige, or the use of Galileo as a symbol of European dynamism, technological capability, and cultural attraction, weighed heavily on European decision-makers in their assessments of the need for Galileo.

Although prestige was a factor[231] it was not as significant a factor in the 1990s as it had been in the 1960s for the following reasons.[232] The European Commission is primarily focused on economic matters for its Member States. Spending money on "prestige projects" is not part of its mandate. The Commission is ideally a good steward of European taxpayers' money, and if it is not, it could lose its legitimacy.[233] Similarly, ESA was under the gun for not being efficient in the 1990s and for not being very good at providing space applications which benefited European citizens directly. ESA

[231] Beidleman, "GPS vs Galileo," 129.
[232] In the 1970s European space activities began to focus on using space as a tool to benefit European citizens rather than for prestige. Dupas and others, "A Franco-German View," 106.
[233] Marco Malacarne, European Commission, interviewed by author, September 24, 2007.

participation in the International Space Station was significantly curtailed by its Member States in the 1990s for just such reasons. The cost-benefit of huge investment in the International Space Station was hard to justify on cost effectiveness grounds and improving European citizens' daily life, and the prestige associated with a European manned space capability was deemed inadequate grounds for the huge expense. The result is that ESA also had to focus on delivering tangible benefits to its Member States' taxpayers. Viewing prestige as a significant driver of European space programs was an "old fashioned" way of thinking.[234]

The 1990s saw the rise of a second space-age in which commercial space applications, global market shares, improving services, and high technology jobs became more important as motives for investment in space than national and international symbolism and prestige; or the larger ideas about mankind's manifest destiny in space;[235] or the idea that technological and social change could be politically organized and directed activities.[236] Prestige and autonomy were out and liberal economics were in.[237] "Since the end of the Cold War, the stakes in the space race have shifted from prestige…towards market shares and dominance for applications," said the 1999 EC Working Document "*Towards a Coherent European Approach for Space,*"[238] In addition, the prevailing logic was that private funding be sought for space activities.[239] These trends were apparent at the national level also.

[234] Naja, interviewed by author, Paris, France, September 16, 2007.
[235] Pace, "Merchants and Guardians," 8.
[236] McDougall, *The Heavens and the Earth*, 1985.
[237] Bertrand. de Montluc, "Watersheds in the Modern World: The Space Viewpoint." *Space Policy* 12 (1996): 245-264.
[238] Commission, *Towards a Coherent European Approach for Space,* SEC (1999) 789, final, 5.
[239] Dupas and others, "A Franco-German View," 106.

As noted previously, the United Kingdom was adamantly opposed to prestige projects, and posed stringent tests in the name of the liberal ethic "best value for money" in regard to space activities.[240] Along with this focus came a very strong preference in the United Kingdom for PPPs, so much so, as a matter of fact, that the United Kingdom became "wedded" to the idea of PPPs, which may help explain how Galileo became financially structured as a PPP.[241] In addition, German decision-makers responsible for space were also becoming "overtly reluctant" to engage in prestige programs for reasons of European autonomy.[242]

Finally, although there was some rhetoric about space activities helping to form a stronger sense of European cohesion and a stronger sense of identity, this rhetoric by itself is not a solid indicator of significant ideational motives which could outweigh the many more concrete liberal indicators. In sum, there is not sufficient concrete evidence to conclude that ideational factors weighed the most heavily on European decision-makers' assessments of the need for Galileo. Rather, ideational factors were most likely intervening variables which affected the decision-makers assessments, but did not weigh the most.

The next section parses the above findings further by exploring the relative importance of each level of analysis.

Levels of Analysis: The preceding chronology and discussion also demonstrates that the international level was relatively the most significant level in the 1999 Galileo decision.

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[240] Bertrand de Montluc, "The Changing Face of the European Space Sector: the Policies of Germany, Italy, and the United Kingdom." *Space Policy* 13 (1997): 10.
[241] Hill, "Superstate or Superpower?" 5.
[242] Bertrand de Montluc, "The Changing Face of the European Space Sector: the Policies of Germany, Italy, and the United Kingdom." *Space Policy* 13 (1997): 10.

European decision-makers acting "as if" the European Union was a nation-state in the international system were responding primarily to liberal factors as demonstrated above. The EU aggregated its Member States' interests and preferences, as well as its own interests and preferences and developed distinctive international level preferences.[243] Galileo was an option which was chosen by European decision-makers in order to serve the interests of the European Union as a discreet actor on the international stage.

The European Union overall managed and controlled the nascent Galileo program and also contributed significantly to its financing. Recall that in 1994 the European Commission adopted the role of GNSS policy coordinator and the role of "catalyst" for the European contribution to the development of a GNSS.[244] In June 1994, European Transport Ministers at the ECAC directed Member States to coordinate a European contribution to GNSS-1 and GNSS-2.[245] Thereafter, DG TREN was given the lead in managing formal cooperation among these organizations, in the "European Tri-partite Group" (ETG) with the purpose of implementing a European contribution to GNSS.[246] The Council of European Union Ministers sanctioned this role for the Commission and called upon the EU to provide "political impetus" for projects related to the information

[243] This argument is supported by Per Martinsen's analysis of the development of a unique European Union strategic culture which is more than the sum total of its Member States' interests. Per M. Martinsen, "The European Security and Defense Policy (ESDP) – a Strategic Culture in the Making?" (paper presented at the ECPR Conference, Marburg, Germany, September 18 – 21, 2003), 9. http://www.essex.ac.uk/ecpr/events/generalconference/marburg/papers/17/1/Martinsen.pdf. (accessed August 15, 2007).

[244] Madders, *A New Force at a New Frontier*, 549. Also see Council Resolution of 19 December 1994 on the European Contribution to the Development of a Global Navigation Satellite System (GNSS), (94/C 379/02), Official Journal of the European Communities C 379 (Brussels, EU, December 31, 1994), 0002-0003.

[245] Lembke, *The Politics of Galileo*, 6.

[246] Barbance and Bergquist, "Satellite Navigation Activities," 155-161.

society, and to “initiate” and support work needed for the design and organization of a civil GNSS [247]

The international level also mattered more than the inwardly focused European level due to the simple fact that Galileo cannot be properly considered outside the context of its relationship to GPS and Europe’s collective relationship with the United States. The institutional relationships and interactions between DG TREN, Pillar Two, ESA and member states was important but in nearly all respects, Galileo was a reaction to GPS. First, GPS conclusively demonstrated the commercial, civil, and military importance of satellite navigation in the 1990s. In response, Galileo was designed and scheduled in constant reference to GPS. Galileo was designed to be better than GPS by being more available, more precise, more reliable, and by providing capabilities that GPS lacked, such as signal integrity monitoring. In addition, Galileo was designed to be interoperable with GPS. Furthermore, the 1999 “Galileo” communication called for a decision to be made urgently in order to take advantage of the “window of opportunity” for Galileo to capture GPS market share before the United States upgraded GPS satellites, irreversibly set the international standard for satellite navigation signal structures, and established a permanent highly lucrative monopoly on satellite navigation services. This interplay with GPS definitely had an affect on European decision-makers’ assessments of the need for Galileo and is best accounted for at the international level. Therefore, it is reasonable to argue that European level considerations were important but not relatively the most significant level in European decision-makers assessments of the need for Galileo.

Likewise, Galileo cannot be adequately considered without due regard for the international aspects of the growing global commercial space market, and Europe’s

[247] Lembke, *The Politics of Galileo*, 6.

collective role in it. This is also accounted for best at the international level, although the industrial level was also very important in and of itself, as described next.

The prime contractors from the European "upstream" space industry consistently wanted to expand European involvement in space through greater public funding for space activities.[248] Naturally, the European space industry figured to benefit greatly from the multi-billion euro Galileo program. Galileo would create demand for a large number of satellites, launch vehicles, and major operational infrastructure. The resulting greater economy of scale would make the European space sector more competitive globally. In addition, the technological challenge would boost the industry's comparative advantage, and the large inflow of public money into the European space sector would help strengthen the European space industry and make it more competitive in the global commercial space market.[249]

It is difficult to conclude, however, that the industrial level was relatively more influential than the other levels in 1999. In separate interviews conducted in the autumn of 2007 in Paris and Brussels, officials from the EC, ESA, Eurospace, EADS, and academia consistently stated, without hesitation, that the Galileo initiative was driven more by official political and economic interests than by industrial lobbying.[250] However, this assertion is difficult to confirm one way or another, since in many ways there is often a symbiotic relationship between industrial, technological, and governmental interests.[251]

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[248] Barbance and Bergquist, "Satellite Navigation Activities," 155-161.
[249] Eurospace, "Space: a Challenge for Europe." *Space Policy* 11 (1995): 227. Lembke, *The Politics of Galileo*, 7.
[250] Lungu in "Power, Techno-Economics, and Transatlantic Relation," 20, reports the same finding, citing an October 2000 interview he conducted with an ESA official.
[251] Also see McDougall, *The Heavens and the Earth*.

Space industry representatives were members of the High Level Industry Working Group[252] and the GNSS High Level Group, and were often granted membership or observer status in other European-level space policy coordination deliberative bodies. So there is no doubt the space industry had significant influence at the EU through official channels, and it is reasonable to assume that the space industry had significant influence at the national level.[253] Nevertheless, European decision-makers' well known strategic concerns about international level technological autonomy, global economic competitiveness, and Europe's global image as a technological leader, as well as the initial impetus for more efficient means of air traffic control and better transportation infrastructure in general,[254] make it reasonable to argue that the industrial level was perhaps relatively less important than the international level.[255]

It is also safe to say that the national level was very important in the Galileo decision, and possibly the most influential level. "Nothing happens without Member State approval," as Ralf Huber, a European Commission official, said.[256] The realist perspective, that the European Union's decisions simply reflect the Member States interests, is assumed by many observers in much of the literature on Galileo.

However, it is not difficult to argue that the leading states had conflicting preferences which make it unlikely that the national level, by itself, was the most important level. Chapter Two discussed many of the structural differences among the

[252] Lungu, "Power, Techno-Economics, and Transatlantic Relations," 10.
[253] It is beyond the scope of this report to explore national level industrial policy and relations.
[254] Beidlemann, "GPS vs Galileo," *Astropolitics*, 3; 132-136. Lungu, "Power, Techno-economics, and the Transatlantic Relationship." Johnson-Freese, *Space as a Strategic Asset*, 2007. Lembke, "EU Critical Infrastructure."
[255] Likewise, there was no GPS industry association in Europe as of 1997 according to a RAND. European interest in GPS focused on government driven public transportation planning for aircraft, trains, and future intelligent vehicle highway system. This study made similar findings regarding Galileo.
[256] Ralf Huber, interviewed by author, Brussels, BE, September 20, 2007.

programs while Chapter Four, above, discussed many of the different historical motivations behind each states' space program. The international level was needed to ameliorate the diverse preferences of the European states and overcome conflicting interests and perspectives.

We know, for example, that the United Kingdom has not had a significant leadership role in the European space sector since the 1970s and focused its civil space efforts on economic benefits, and was content to rely upon the United States for its military space capabilities, including PNT capabilities. Likewise, Italy was never a major driving force behind European space projects in the 1990s or earlier.

We also know that Germany and France were the driving forces behind European space activities. However, even though Germany traditionally took on a strong role in the European space sector with an aim of strengthening its industrial competitiveness, its economic difficulties related to reunification, its strategic priorities in Central and Eastern Europe in the 1990s, its proclivity to use ESA as the natural framework for its space activities, and the importance it attached to transatlantic cooperation and counterbalancing the pursuit of European autonomy[257] make it reasonable to argue that German preferences were definitely important, but were different from the preferences of the other key states.

France, by itself, was the most important national level actor and prioritized strategic autonomy and security. However, in the European Commission and in the Council of Ministers, French interests would also be in competition with the divergent interests of Germany, Italy, the United Kingdom, and other countries like Spain, as well as the EC's own interests as an independent actor. The result is that French national level

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[257] Montluc, "The Changing Face of the European Space Sector," *Space Policy,* 10.

influence, while critically important, could have become diluted by the need to bargain and compromise with other states at the European Commission.

Likewise, France is well known for using ESA as an instrument for the pursuit of its national space ambitions[258] and for using the EU as a means to advance its strategic interests collectively when it does not have the critical mass politically or financially to advance them unilaterally or bi/multi-laterally. However, the French realized in the 1990s that the French national economy of scale was insufficient in the era of globalization to maintain their ambition for national level industrial, technological, and military autonomy and that therefore, French ambitions for autonomy would have to evolve to the European Union.[259] The 1994 French Defense White Paper noted that aerospace was a high technology sector in which France must remain competent, that dual-use technologies were useful, and that France must cooperate within the auspices of the European Union on future armament programs due to the expense of modern weapon systems. Therefore, it is reasonable to argue that French national level interests were a significant driver of the Galileo decision but the French were willing to cede a significant degree of control to the European Union. This further strengthens the argument that the international level was relatively the most important in European decision-makers' assessments of the need for Galileo.

One last indicator makes it reasonable to argue that the international level was more significant than the national level. Simply put, the EC – a supranational organization - manages the Galileo program. EC decisions concerning Galileo are taken using qualified majority voting rules. Consensus among all member states is not required

[258] Montluc, "The Changing Face of the European Space Sector," 11.
[259] Lungu, "Power, Techno-Economics, and Transatlantic Relations," 21.

to move the Galileo program forward. If the national level were the most significant, Galileo should either have been structured as a bi/multi-lateral program or structured within a new, functional intergovernmental organization.

Previous collective European space application programs which were more clearly driven by the leading European states were developed and made operational by ESA, an intergovernmental organization. Then they were transferred to new functional intergovernmental organizations, e.g. the European Telecommunications Satellite Organization (EUTELSAT),[260] and the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT). Indeed, there was some discussion of Galileo taking a similar path with a new IGO such as a "EUNAVSAT," but that alternative was not chosen.[261] Member States have much more leverage in intergovernmental organizations than in the supranational European Commission. Apparently, key European decision-makers purposefully placed responsibility for the development of Galileo at the European Commission in order to make use of the EC's power of initiative, agenda setting power, ability to overcome diverse Member State interests, and ability to act collectively "as if" it is a nation state in the international system. Otherwise, it is reasonable to argue that Galileo would either have been structured as a bi/multi-lateral program or structured within a new functional IGO.

Given the above considerations, this study makes a reasoned judgment that the international level was relatively the most significant level of analysis in the 1999 Galileo decision. In addition, as we'll see, similar arguments hold for the 2002, 2004, and 2007

[260] "EUTELSAT: An International Company," (Paris: EUTELSAT, 2007). http://www.eutelsat.com/news/media_library/brochures/international_company.pdf (accessed February 20, 2007).
[261] Barbance and Bergquist, "Satellite Navigation Activities," 155-161.

decisions investigated in this study. Therefore, I argue that the international level was the most significant level throughout the period under investigation in this study.

Summary: This chapter provided a chronology of events up to the 1999 decision to start the Galileo Definition Phase and then assessed the relative weight of realist, liberal and ideational factors on European decision-makers assessment of the need for Galileo. It was argued that liberal factors influenced European decision-makers most heavily. It also judged that the international level mattered the most.

We may now proceed to examine the sequence of events that nearly killed the Galileo program and led up to the second decision point under study, the much delayed and contested 2002 decision to start Galileo's Development Phase.

Chapter Five:
Getting on Course

Chapter Five traces the events during Galileo's Definition Phase up to the March 2002 EU decision to approve Galileo's Development Phase. The Galileo program barely survived the Definition Phase and this chapter seeks to shed light on the obstacles it faced and the impetus needed to keep the project alive.

This chapter found that realist factors at the international level were the most important motivators for Europe to press ahead with Galileo in spite of serious objections from the United States and unresolved funding and management questions. Obstacles caused by questions concerning the feasibility of private financing were only overcome after the Transport Council came under pressure from the European Council and national level military leaders whom stressed the strategic importance of Galileo and its importance to European defense cooperation.

However, liberal factors still carried significant weight. Galileo's public funding still came from civil sources and a PPP was still planned for the Deployment and Operational Phases. Organizationally, the Galileo project was still managed and controlled by civilian authorities. Nevertheless, liberal factors were most likely significant intervening variables which affected the decision-makers' assessments, but did not weigh the most.

In addition, the evidence suggests that ideational factors were relatively the least important during this period.

1. Defining Galileo

The 19 July 1999 Council of the European Union Resolution which approved Galileo's Definition Phase stated that it expected the EC and Member States to take measures to ensure that largely private interests would develop and finance Galileo. It stated that meeting this requirement "would be a central factor in deciding on future phases of the project."[1] The Resolution also specified that the Definition Phase should deliver "exhaustive" results on feasibility, design, capability, structure, reliability, control and cost of the system.[2] The Definition Phase was expected to conclude in December 2000 with a report and recommendations to the Transport Council of the European Union to aid in their final decision on whether or not to go ahead with the Galileo project.[3]

The July resolution also directed the EC to immediately explore the potential for cooperation with the United States and Russia. By November of 1999 formal negotiations with the United States about how Galileo and GPS could be made

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[1] Council of the European Union, "Definition Phase."

[2] A number of projects and studies were conducted by the EC and ESA during the Definition Phase to fulfill this directive including:

- GALA for the overall architecture definition
- GEMINUS to support the GALILEO service definition
- INTEG for EGNOS (European Geostationary Overlay Service) integration into Galileo
- SAGA to support the GALILEO Standardization process
- GalileoSat for the space segment architecture definition
- GUST related to GALILEO receivers pre-specification and certification
- SARGAL related to potential SAR (Search and Rescue) applications of Galileo.
- GALILEI defined the overall service and user approach for GALILEO, in particular on the following topics:
    - architecture of GALILEO Local Components and customisation for some key applications,
    - interoperability between GALILEO and other systems (GNSS, GSM/UMTS, etc.),
    - co-ordination and protection of frequencies used by GALILEO,
    - standardization and certification aspects,
    - market observatory of applications using GALILEO,
    - definition of the legal, regulatory and institutional framework of GALILEO.

This information is taken nearly verbatim from "GALILEO: European Satellite Navigation System" at http://ec.europa.eu/dgs/energy_transport/galileo/programme/phases_en.htm

[3] Ashkenazi, "The Challenges Facing Galileo," 185.

compatible and interoperable had begun.[4] The resolution also expressed a desire for cooperation with third countries.

One of the first tasks in the Galileo Definition Phase was to set up an adequate institutional structure for the Galileo program. An institutional structure had been spelled out in the July 1999 Council resolution. The resolution invited the EC to immediately set up a Galileo Steering Committee, chaired by the EC and composed of EU and ESA Member State representatives, with ESA as an observer. The Galileo Steering Committee would oversee work on Galileo and handle contacts with non-member states.

A Galileo Program Office with a permanent secretariat and a joint EU/ESA Program Management Board was also to be set up to provide technical support to the Galileo Steering Committee and to coordinate studies and action among the complex web of interested parties and to start work on the legal and institutional arrangements.[5] The joint EC/ESA Galileo Program Office opened on 4 May 2000 and created the first standing link between ESA and the EC.[6]

A reporting process from the EC to the Galileo Steering Committee concerning system security issues was to be set up. In addition, a reporting process from the EC to the Council of the European Union was to be set up to report on the Galileo's finances and overall progress. There was no established reporting process to any security or defense authorities.

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[4] Lembke, "EU Critical Infrastructure," 69. Taverna, "Europe Launches Satnav Project."
[5] Taverna, "Europe Launches Satnav Project."
[6] Franco Baracina, "ESA and the EC Open Joint Office to Accelerate Work on Galileo Satellite Navigation Programme," *M2 Presswire*, May 5, 2000. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pqdweb?did=53516169&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD (accessed January 8, 2008).

The July 1999 Council Resolution concentrated most of its attention on financial issues. First it invited the EC to explore potential revenue generating services which Galileo might be able to create by charging levies and charging for access to high quality services (i.e. the most accurate PNT signals).

Second, in the interest of establishing Galileo as a PPP as soon as possible, the July Council Resolution directed the EC to develop an estimate of the cost and cost risks of the entire Galileo program life cycle.

Third, the resolution invited the EC to examine the possibility of using multi-annual contributions from the EC's Trans-European Network (TEN) budget, the EC's Fifth Framework program R&D budget, and any other budgets which could be used in cooperation with ESA (which ruled out defense/security budgets).

Included in this long list of activities was the Council's call for the EC to urgently initiate action to secure the ideal portion of the frequency spectrum needed to make Galileo signals the most accurate possible.[7] In fact, ESA and France had actually already filed for Galileo frequency allocations before July 1999.[8] The portion of the spectrum that was allocated for Galileo's PRS signal by the International Telecommunications Union (ITU) at the 2000 World Radio Conference happened to overlap the planned (but not as yet officially requested or reserved frequency) of the future upgraded GPS III military signal, their projected to be launched in 2011. This potential interference

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[7] A discussion of the advantages of certain portions of the electromagnetic frequency spectrum for global navigation satellite services is outside the scope of this study. The frequency spectrum is a global public good which is managed by International Organizations. Frequency allocations are handed within Europe by the European Conference of Postal and Telecommunications Administrations and globally by the International Telecommunications Union.

[8] Taverna, "Europe Launches Satnav Project."

between GPS and Galileo signals raised alarm in the United States. This issue will be discussed in greater depth below.

Once funding for Galileo was released in December 1999, the EC and ESA set out to define the basic elements of the system. ESA was responsible for conducting studies on the Galileo satellite constellation, ground segment, and associated technology. ESA placed these activities organizationally within its GalileoSat program. The EC was responsible for policy, legal, regulatory, and institutional issues.

The EC set up the Galileo Steering Committee, as the European Council had recommended, but this institutional structure ran into problems rather quickly. First, the EC had no experience in the management of large space programs which required the delivery of tangible results, i.e. hardware. Normally, European transportation infrastructures such as roads, rails, airports, and telecommunication networks were developed and owned at the national level, and the EC (DG TREN) concerned itself with creating the legal and regulatory mechanisms that allowed the nationally developed capabilities to operate smoothly together. Galileo was the first time the EC took on managing the development of a European-wide infrastructure itself.[9]

Institutionally, the EC was not very well prepared for this complex task. For example, it was decided that the project structure had to allow for democratic influence and political control by all participating nations and private sector organizations.[10] Ideally this might be desirable, but it created obstacles practically. Complicating the picture even more, there was no clearly defined public customer for Galileo and the participating states did not agree on the pace of the program or even the purpose of the

[9] Both Britain and Germany questioned the EU bureaucracy's ability to manage the project. The Economist, “Eppur si Muove--or Maybe Not,” *The Economist*, May 22, 2002.
[10] Lembke, *The Politics of Galileo,* 15.

program. As mentioned in Chapter Four, the French and Italians wanted Galileo for more strategic and political reasons, including military uses, while Germany and Britain were more interested in it for the commercial prospects. Since the Galileo project had no designated lead nation to guide the way forward, the gap between these competing perspectives was unresolved.

Of course the military security potential of Galileo also caused disagreement among the states. If security purposes (including military security) were a prime reason for Galileo, then the highest quality signals should be encrypted and the Galileo program would ideally be structured one way. If commercial profit was the priority, or if the use of Galileo as a public good for such activities as air navigation was Galileo's main purpose, then Galileo's best signals should not be encrypted and the Galileo program would be set up another way. These issues were difficult to resolve.

Even though there was still no European military requirement for Galileo in January 2000, (despite the recent war in Kosovo) there was discussion about the military's role and recognition that in time of crisis or war the military would have to take control of all navigation aids, including Galileo.[11] But the proper balance between national military requirements and the vision for international civil control of Galileo had yet to be adequately considered. In addition, the crucial question of who would have ultimate operational control of Galileo had not yet been dealt with forthrightly. In fact,

[11] "Galileo: Ambitious Plans, Unanswered Questions," *Global Positioning and Navigation News*, January 26, 2000. http://proquest.umi.com.proxygw.wrlc.org/pqdweb?index=0&did=48333417&SrchMode=2&sid=1&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1223242553&clientId=31812 (accessed January 8, 2008).

the Definition Phase never adequately answered the fundamental question of who would control "the keys" to the system.[12]

Grappling for answers to these types of basic questions diluted the success of the Definition Phase and dogged the Galileo Steering Committee.

RAND reported on Galileo in the summer of 2000 saying, "[it] is not clear that full thought has been given either to the European military implications or to those for U.S. and allied (NATO) operations."[13] In addition, no military requirements were explicitly taken into account in the design of Galileo.[14] John Logsdon also noted that European defense ministers had limited opportunity to influence Galileo's definition. According to Logsdon, Galileo's specific military applications, while important, were secondary considerations. Moreover, Logsdon notes that European defense ministers were wary about expressing too much interest in its development so as to avoid being asked to contribute to Galileo's funding.[15] However, Johan Lembke reports an interview with an unnamed official from Alenia who said that "military entities" were "extremely active" in the definition of the Galileo system due to the fact that military representatives were present in each panel defining Galileo.[16] However, it is unclear if they were providing requirements for the military *use* of the system, or were providing input on how the military could help prevent and detect interference or the malicious use of the system by adversaries. This is an important distinction. In another regard, no thorough

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[12] Global Positioning and Navigation News, "Galileo: Ambitious Plans."
[13] Hura et al., "Chapter 6: Space Developments," 71.
[14] Gerard Brachet and Bernard Deloffe, "Space for Defense: A European Vision," *Space Policy* 22 (2006): 98.

[15] Logsdon, "A Security Space Capability for Europe?" 275.
[16] Lembke, "EU Critical Infrastructure," 64.

analysis of the military market for Galileo was being performed, even though the military sector had the potential to be one of the biggest users of Galileo.[17]

Meanwhile, the European aerospace industry had positioned itself to respond to the approval of Galileo's Definition Phase. In late 1999, four of the largest space industry actors in Europe: Alcatel Space Industries of France; Alenia Spazio of Italy, Astrium GMbH of Germany; and Astrium Ltd. of the United Kingdom, joined together to establish a legal entity called Galileo Industries, S.A.[18] Galileo Industries was expected to lead the effort to build the satellites, ground segments, and other infrastructure.[19] This signaled the space industry's support for Galileo, (as a contracting opportunity at the least), but the level of its financial contribution to the project was not addressed.

The Thales Group was a second major industry grouping hoping to become involved in Galileo. The Thales Group was primarily concerned with service provisioning and major system integration. It was also a leading actor in the European defense sector.[20]

Of course while various Galileo Definition Phase studies and activities got underway in the spring of 2000, the context in which Galileo existed continued to change.

First, the 23-24 March 2000 Lisbon European Council set a new strategy for boosting employment in the EU, modernizing the economy, and strengthening social cohesion in a knowledge-based Europe. The "Lisbon Strategy" endeavored to make the EU the most competitive, knowledge-based, information economy in the world. At the

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[17] "Galileo Military Market," *Global Positioning and Navigation News*, January 26, 2000. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=48333464&sid=6&Fmt=3&clientId=31812&RQT=309&VName=PQD (accessed January 8, 2008).
[18] John Gallimore, "Galileo: The Public-Private Partnership," *GPS World*, September 2000, 58. http://findarticles.com/p/articles/mi_m0BPW/is_9_11/ai_n27563080. (accessed, January 8, 2008). Also see Lembke, *The Politics of Galileo*, 13.
[19] Lembke, "EU Critical Infrastructure," 61.
[20] Lembke, "EU Critical Infrastructure," 61.

same time, the EC and ESA were in the process of jointly drafting a European Space Strategy. The Lisbon Strategy, the European Space Strategy, and the Galileo project came together later in the Fall of 2000 as described below.

Second, in late March 2000, ESA's Director General Antonio Rodota asked a special committee of experts from outside the space community to provide advice on how ESA should evolve. The three "Wise Men" of this committee were tasked to examine the organization of the public space sector in Europe and ESA's role in it; ESA's relationship with the EU; and potential synergies between civil and defense aspects.[21] They began work in May 2000 and delivered their influential final report in November 2000, also discussed below.

Third, on 28 April 2000 President Clinton announced that the United States would turn off GPS Selective Availability at midnight on 1 May.[22] Although this decision was unexpected in some quarters,[23] recall that the 1996 U.S. GPS Policy declared the U.S. intention to discontinue the use of Selective Availability "within a decade," and that it set 2000 as the year in which the President would begin making an annual determination on the continued use of Selective Availability. With Selective Availability turned off, the accuracy of the GPS SPS signal was better than 5 meters.[24] A U.S. Department of Transportation official stated that the decision to turn off Selective Availability should be

[21] ESA, "Report of the "Wise Men" Disclosed in Paris Today: Towards a Space Agency for the European Union," November 9, 2000. http://www.esa.int/esaCP/GGGQS06UGEC_index_2.html (accessed January 7, 2008).
[22] Presidential Memorandum, "Direction to Discontinue the Use of Selective Availability" (April 28, 2000).
[23] "Clinton Adds to WRC 2000 Intrigue with Decision to End GPS Signal Degradation," *Satellite News*, May 8, 2000. http://proquest.umi.com.proxygw.wrlc.org/pqdweb?index=0&did=53577274&SrchMode=2&sid=2&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1223257605&clientId=31812 (accessed January 8, 2008).
[24] Hura et al., "Chapter 6: Space Developments," 71.

"considered evidence of genuine joint civil/military use, and that civil interests are being given high or equal representation in the management of the system."[25]

The timing of Clinton's decision caused some observers, especially in Europe, to conclude that the United States was attempting to undermine the rationale and business case for Galileo. As one Galileo consultant stated, "The U.S. is trying to make GPS more appealing and give [European] administrations less reason to support Galileo."[26]

The timing of the decision just prior to the 8 May – 2 June 2000 World Radio Conference (WRC) attended by 189 Member States of the ITU was considered evidence by some that the United States was trying to discourage the WRC from allocating the frequency spectrum requested by Europe for Galileo. However, this was not true. Admittedly, conflict had arisen between the United States and Europe in 1997 over spectrum allocation issues. Driven by the "dot com" boom, Europe desired spectrum allocations for a new generation of telecommunication satellites. However, the spectrum allocation that Europe wanted for these telecommunication services was incompatible with GPS PNT services.[27] By 2000 the combination of the "dot com" bust and the European decision to pursue the Galileo project led to a change in European priorities. At the 2000 WRC, Europe agreed with the United States to protect that part of the spectrum that is most useful for PNT services.

Nevertheless, within the ITU approved portion of the spectrum that was allocated for PNT services, another conflict between the United States and Europe arose. Both

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[25] "U.S. Gears Up to Protect, Extend GPS Spectrum at WRC," *Global Positioning and Navigation News*, May 3, 2000. http://proquest.umi.com.proxygw.wrlc.org/pqdweb?index=0&did=53468199&SrchMode=2&sid=1&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1223257405&clientId=31812 (accessed January 8, 2008).
[26] Satellite News, "Clinton Adds to WRC 2000 Intrigue."
[27] Thanks to Dr. Scott Pace for explaining the issues surrounding the so-called "spectrum wars."

wanted to use some of the same portion of the spectrum in the future. The Galileo PRS signal would overlay the GPS III military signal. According to the EC, the ITU supported the EU's "right" to position its Galileo PRS encrypted signal where it saw appropriate within the approved PNT services spectrum allocation, regardless of potential interference with the future GPS military signal.[28] However, the ITU's role is to allocate portions of the spectrum for particular services. States (or in this case the EU) actually "authorize" the use of particular frequencies. The ITU does not have the power to say how states authorize or use the allocated spectrum. Therefore, saying the ITU supported the EU's "right" to position Galileo's PRS encrypted signal where it saw appropriate does not really bolster the EU position.[29]

Galileo's planned PRS signal, however, now directly threatened GPS and U.S. security interests as understood within the frame of the U.S. NAVWAR concept. Without delving into the technical details, the United States faced two problems. First, the Galileo PRS encrypted signal would overlay the planned GPS III military signal, potentially causing interference. Second, if the United States wanted to jam the Galileo PRS frequency in a crisis or war, the United States would effectively also be jamming the GPS III military signal.

Scott Beidleman in "GPS vs Galileo" pointed out the political leverage that European decision-makers would gain under such a scenario. First, they could force the United States to include European decision-makers in any American decision to jam Galileo or GPS in a crisis. Second, in anticipation of such consultations, a political agreement between the United States and the EU to establish a joint decision process

[28] European Commission, *White Paper: European Transport Policy for 2010: Time to Decide,* (Luxembourg: EC, 2001), 94. And Braunschvig et al "Space Diplomacy," 159.
[29] Thanks to Dr. Scott Pace for explaining this nuanced point.

would be required. In this way, the EU would finally gain some leverage over GPS operational decisions. In any case, the United States, which already regarded Galileo as a commercial and strategic challenge to GPS, now also viewed Galileo as a military security challenge. Although somewhat ambiguous due to the fact that the portion of the frequency spectrum that was reserved for Galileo was actually, due to highly technical reasons, the best part of the spectrum for Galileo's civil and commercial purposes, this frequency issue may tentatively be considered as an indication that realist factors were in play in the evolution of Galileo.

Meanwhile, European decision-makers at the European Council meeting at Feira, Portugal on 19-20 June 2000 decided that the ESDP's credibility and effectiveness relied upon improving European military capabilities. An inventory of European military capabilities was ordered and was to be delivered in November 2000.

Galileo Definition Phase studies continued over the summer of 2000. Then in September 2000 the EC (DG Research) and ESA released the jointly developed "*European Strategy for Spac*e" which the Council of the European Union (Research) had requested in December 1999.[30] It was endorsed by the EC Commissioners in a 27 September Communication called *Europe and Space – Turning to a New Chapter*.

The *European Strategy for Space* and the *Europe and Space* documents linked European space activity to three major objectives of the European Council: to make Europe the most competitive economy in the world (Lisbon Strategy); to develop a European Security and Defense Policy (ESDP/Headline Goals); and to enlarge the European Union. In addition, the strategy pointed out the potential benefits of dual-use

[30] Council of the European Union, "Council Resolution of 2 December 1999: On Developing a Coherent European Space Strategy," *Official Journal of the European Union*, C 375/01 (Brussels: EU, December 1999).

systems and highlighted Galileo as the first program to be implemented under this new approach to space in Europe. Space systems were acknowledged as key instruments for the achievement of these strategic goals and European space activities were now to be integrated in the broader political and economic strategy of Europe.[31] European Research Commissioner Philippe Busquin emphasized that space activities increased Europe's political weight and supported the EU's presence on the international stage. Furthermore, he stated that there was a "profound link" between space and the EU's political objectives and said that European success in space was symbolic of European cooperation.[32]

Although the strategy was primarily civil in nature it included consideration of military security issues and noted that the EU should have the lead role in coordinating Europe's space activities, including military activities.[33] The official linkage of Galileo to European Union strategic objectives in the *European Space Strategy*, including the ESDP and military space activities, may represent a solid indicator that realist factors were weighing in key European decision-makers' minds in their assessments of the need for Galileo. However, ESA's involvement in the joint development of the strategy and its heavy participation and funding role in Galileo, along with its civilian character and "peaceful purposes" mandate, clouds the analysis. In addition, the push for the European Space Strategy and closer links between the EC and ESA came mainly from the EC Research directorate. However, the EC Transportation and Energy directorate (DG

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[31] Geraldine Naja, "A Joint European Strategy for Space," *Space Policy* 17 (2001): 83.
[32] Cordis, "Busquin: Space is a European Reality," October 18, 2000. http://cordis.europa.eu (accessed August 3, 2004).
[33] Commission of the European Communities, *Communication to the Council and the European Parliament: Europe and Space: Turning a New Chapter*, COM (2000) 597 final. Brussels: EC, September 27, 2000.
http://www.espi.or.at/images/documents/europe%20and%20space%20turning%20to%20a%20new%20chapter.pdf (accessed August 23, 2007). The European Strategy for Space is within this document.

TREN) was responsible for Galileo and had very little to do with the development of the European Space Strategy. Consideration of these bureaucratic and organizational factors makes it difficult to discern clearly if the *European Strategy for Space* is a firm indicator of a solid link between Galileo and the ESDP.

Meanwhile, in September 2000 the United States threw another obstacle in Galileo's path. The United States accelerated GPS modernization by deciding to upgrade 12 of the 20 GPS Block IIR satellites. These 12 satellites would include an additional civilian signal and two military signals. This effort would hasten the GPS modernization program by approximately eight years and raise GPS accuracy to be on par with Galileo.[34] In addition, reports circulated that the United States intended to stop developing GPS Block IIF satellites and to accelerate the development by two years (from 2011 to 2009) of the much more capable GPS III satellites.[35]

Interestingly, on 6 Oct 2000 U.K. Prime Minister Tony Blair, "the loyal Atlanticist," stated in a speech to the Polish Stock Exchange in Warsaw "Europe today is no longer just about peace. It is about projecting collective power." He added, "Such a Europe can, in its economic and political strength, be a superpower; a superpower but not a superstate."[36] The Anglo-French St. Malo declaration in December 1998; the coming into force of the *Treaty of Amsterdam* on May 1, 1999; the evolution of the ESDP through 2000; and new justification for humanitarian intervention after Kosovo combined

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[34] Beidleman "GPS vs Galileo," 145.

[35] See Beidleman, "GPS vs Galileo," 127, for a rundown of the GPS modernization program, GPS IIR-M GPS IIF, GPS III. Ashkenazi, "The Challenges Facing Galileo," 185. Michael A. Taverna, "Europe Declares Satnav Independence; Europe and the United States Must Now Discuss Thorny Political and Technical Issues Raised by Galileo Approval," *Aviation Week & Space Technology* 156, no. 13 (April 1, 2002): 24. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=112976154&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD. (accessed January 8, 2008).

[36] Tony Blair, "Prime Minister's Speech to the Polish Stock Exchange," Warsaw, Poland, June 10, 2000. http://www.number10.gov.uk/output/Page3384.asp (accessed August 14, 2007).

to make Europe realize that it had a role and responsibility in helping to maintain international order.

An analysis of EU official expressions of policy, (in particular EU Council documents), showed that the discourse in the EU prior to late 1998 stressed the use of civilian means in the EU's foreign policy.[37] After 1998, however, the discourse found in EU Council documents and in the speeches of EU High Representative Solana changed to accentuate a more military orientation for the EU. The discourse included more rhetoric about how the EU's development of military capabilities provided the EU international status and prestige and was a factor in creating the European Union's identity as an international actor.

In addition, in 1999 the Joint Chiefs of Staff of France, Germany, Italy, and Spain established the *Besoins Operationnels Communs* (BOC) in order to identify common operational requirements for a European system of Earth observation satellites. This military initiative was taken outside the framework of the EU, but it demonstrated that decision-makers in leading European countries were increasingly interested in using collaborative efforts within Europe to improve their military space capabilities.[38]

It is apparent that the milieu surrounding European decision-makers and the Galileo Definition Phase was starting to take on more realist overtones. As we have discussed, the EU had been seeking cooperation in negotiations with the United States over GPS and a European GNSS since 1998. Those talks continued in 2000, but when in October 2000 the EU welcomed Russia's willingness to achieve complementarily

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[37] This section refers heavily to the findings of a 2002 constructivist study on the EU's foreign and military policy. See Henrik Larsen, "The EU: A Global Military Actor?" *Cooperation and Conflict: A Journal of the Nordic International Studies Association* 37 no. 3 (2002): 283-302. http://cac.sagepub.com/cgi/content/abstract/37/3/283 (accessed August 15, 2007).

[38] Logsdon, "A Security Space Capability for Europe?" 274.

between Galileo and GLONASS, it was perceived by some in the United States as an indicator that the EU was engaging in balancing behavior against the United States.

November 2000 was a busy month for European space policy decision-makers. On 9 November the three "Wise Men" delivered their report entitled *Towards a Space Agency for the European Union* to ESA's Director General. In it they called for space activities to be integrated into the EU's wider political and economic strategy. They also noted that without a clear space component, the evolution towards the European Security and Defense Policy would be incomplete. They also acknowledge that Galileo had an ESDP dimension and that Galileo should have the capability and suitable organizational mechanism to be selectively shut down over certain areas in time of conflict.[39] In addition, in a reference to the growing popularity of dual-use space application, they pointed out that the space infrastructure for civil, commercial, and security space activities was converging and said it was logical for ESA to use its capabilities "for the development of the more security-oriented aspects of the European Space Policy."[40] They also found that EU security activities were grounded in the "peace strengthening" Petersberg tasks and therefore did not present any problems with the ESA Convention's "peaceful purposes" clause. This was a significant finding because it made the case that there was no reason to stop ESA from engaging in EU security related projects. As a final point, they called for ESA to become the space agency of the European Union.

A week later, on 16 November 2000, the Research Council of the European Union and the ESA Council at the Ministerial Level met for the first time as the European Space Council and adopted resolutions which endorsed the *European Strategy for*

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[39] Carl Bildt, Jean Peyrelevade, and Lothar Spath, *"Towards a Space Agency for the European Union"* Report to the ESA Director General. 9.
[40] Ibid.

Space.[41] A working relationship was jelling between ESA and the EC in which ESA had the lead role in the coordination of the "supply side" of the European space sector (technology, industrial policy, basic infrastructure) and the EC had the lead role on the "demand side" (definition of user needs). Galileo was recognized as an "institutional test case" to demonstrate this relationship and to demonstrate the validity of the new *European Strategy for Space*.[42]

November 2000 also saw the de facto takeover of the Western European Union by the EU as the ESDP continued to evolve.[43] In addition, November saw the ESDP "Capability Commitment Conference" in which EU Member States made initial national military commitments to the ESDP's Rapid Reaction Force and identified European military capability shortfalls. One major shortfall that was identified was space-enabled military command, control, communication and information (C3I) capabilities. These activities were seen as steps which could help the creation of an European integrated military space program. However, the space component as related to PNT issues was neglected and no official document considered the overall use of space assets.[44]

The culmination of European space activities in November 2000 was the 22 November release of the EC Communication on Galileo presenting the results of the Definition Phase. These results were presented at this time in order for them to be

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[41] Naja, "A Joint European Strategy for Space," 81. Recall from Chapter Two that ESA Council Ministers were mostly the Research Ministers, or equivalent, from each ESA Member State. Of course the Research Council of the European Union was also comprised of the Research Minster from each EU Member State. Therefore, the key European decision-makers on European space policy at such a meeting were actually just meeting with themselves (except for ministers representing countries that were members of ESA but not the EU, or vice versa.). However, also recall that Galileo was the concern of the Transport Ministers at the EU, not the Research Ministers

[42] Gomez, "Europe Without Fractures"

[43] Dupas and others, "A Franco-German View," 106.

[44] Alexander Kolovos, "Why Europe Needs Space as Part of its Security and Defense Policy," *Space Policy* 18 (2002): 259.

considered prior to the EU Transport Council meeting on 21 December 2000.[45] The Transport Council would make a formal decision on continuing Galileo at that time. The delivery of this communication was expected to mark the end of Galileo's Definition Phase. In the communication the EC proposed to the EU Transport Council that Galileo be continued, but left critical questions regarding financing and the project's management structure unanswered.

The EC proposed that the Development Phase be funded 100 per cent with public money. It estimated that 1.1 billion Euros was needed for the Development Phase, and recommended that the EC and ESA each contribute 50 per cent. This money was already programmed within the budgets of the EU and ESA. After the Development Phase, it was argued in the communication, there would be no more need for public money. However, the lack of any private investment in the Development Phase was viewed by Britain, Germany and the Netherlands as a lack of commitment by industry.[46] Even so, the private sector was expected to provide 1.5 billion Euros for the Deployment Phase (2006-2007).

However, the feasibility of attracting that much private financing was questionable, especially given the fact that Galileo's business case had been significantly undermined by the United States with its moves to remove GPS Selective Availability and speed up GPS modernization. The question of how much private financing was needed at which specific points in time during the course of the program was also

[45] Commission of the European Communities, *Communication to the European Parliament and the Council on Galileo*, COM (2000) 750 final, (Brussels: EC, November 22, 2000).
[46] EC "Galileo: the European Commission Mobilizes Euros 200 Million in Funding," IP/01/431, Brussels, March 22, 2001. Also see Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 196.

unclear.[47] These were serious problems. Recall that the 19 July 1999 Council of the European Union Resolution stated that ensuring private investment "would be a central factor in deciding on future phases of the project."[48]

What's more, Galileo's project management and legal frameworks were ill-defined. Questions about Galileo's security aspects versus its commercial services (discussed previously) remained unresolved as well. In addition, from an industry perspective there was too much uncertainty about the profit potential of the Galileo program. This uncertainty was caused by the fact that GPS was available for free, there was no proven market for precise PNT subscription services, and any potential return on investment was in the distant future.

Nevertheless, the EC Communication recommended creation of a provisional, coordinated management structure for the Galileo project involving the EC and ESA. It also recommended the creation, as soon as possible, of a single, definitive management structure with an investment budget combining all the funds earmarked for the project.[49]

At the 8-9 December European Council Summit in Nice, European Prime Ministers and Heads of State endorsed Galileo and urged the upcoming Transport Council to define arrangements for Galileo. However, things did not go as hoped at the 20-21 December 2000 meeting of European Transport Ministers at which the decision on whether to proceed with Galileo was to be made.

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[47] ESA, "ESA Continues Work on Galileo Pending EU's Deferred Decision," January 18, 2001. http://www.esa.int/esaCP/GGGSCUMVPHC_index_2.html (accessed January 7, 2008).
[48] Council of the European Union, "Definition Phase."
[49] Commission of the European Communities, *Continuation of the Galileo Project: The Commission Underlines the Need for Rapid Decisions*, Press Release, IP/00/1336 (Brussels, Europa, November 22, 2000).
http://europa.eu/rapid/pressReleasesAction.do?reference=IP/00/1336&format=HTML&aged=1&language=EN&guiLanguage=en (accessed January 25, 2008).

On 20 December the ESA Council approved funding for initial design work, conditional on a similar approval from the EU Transport Ministers. But on 21 December the EU Transport Council could not reach consensus, primarily due to funding issues, and decided to postpone committing wholeheartedly to Galileo. ESA, the EC, and the space industry were taken aback.[50] In addition to the unresolved financial and structural issues noted just above, there were also many unresolved questions including: Galileo's market potential; how EGNOS would be integrated with Galileo; legal liabilities issues concerning damages or injuries resulting from faulty Galileo performance; frequency allocation issues; and ground infrastructure design issues.[51]

So instead of giving Galileo a clear go ahead to enter the Development Phase, the EU Transport Council deferred the decision until April 2001, and invited the EC to more precisely define the nature of the Deployment Phase PPP and to more clearly define the future management and organization of the Galileo program.[52] Apparently the results of the Definition Phase had not met the July 1999 EC Transport Council's instructions to deliver "exhaustive" results on feasibility, design, capability, structure, reliability, control, and cost of the system.

Nevertheless, ESA went ahead with initial design work after "special measures" were approved on 30 January 2001 by a special meeting of the ESA Navigation Programme Board.[53] Since the European Transport Council had deferred a decision on 21

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[50] Lembke, *The Politics of Galileo*, 9-10.
[51] Ibid.
[52] ESA "ESA Director General Meets the Press," ESA, January 17, 2001. http://asimov.esrin.esa.it/esaCP/GGGUSJLVPHC_index_0.html (accessed November 4, 2008). Also, ESA, "ESA Continues Work on Galileo Pending Deferred Decision," ESA, January 18, 2001. http://asimov.esrin.esa.it/esaNA/GGGDJ8NVPHC_index_0.html (accessed November 3, 2007).
[53] ESA "1st Slice of GalileoSat Workplan Approved," ESA, February 5, 2001. http://asimov.esrin.esa.it/esaNA/GGGUTOKPEIC_index_0.html (accessed November 3, 2007).

December, the funds ESA had conditionally approved on 20 December could not be spent unless such special measures were taken.

In a parallel thread, an indication of growing European interest in the military uses of space capabilities occurred in January 2001 when France and Italy signed an agreement for dual-use Pleiades and Cosmo-Skymed Earth observation satellites.[54] This collaborative effort was specifically designed to meet the requirements of both military and civilian users. Another indicator in January 2001 was the German government's invitation to tender for Germany's first military satellite, the SAR-LUPE reconnaissance satellite.[55]

On 13 February 2001 the EC presented the *Galileo Mission High Level Definition* (HLD) document. Member States, users, and potential private investors had consulted during the Definition Phase to produce this program reference document. The HLD officially provided the main characteristics and performance standards of the Galileo system including specific information about the number of satellites, orbits, frequencies, types of navigation signals, the ground segment, and the development plan and costs. It was the framework for the Galileo program and formed the basis for the *Mission Requirements Document* and the *System Requirements Document*.

It also discussed the Public Regulated Service (PRS) signal which was considered the signal most applicable to the military and which France insisted be included as a Galileo capability. The HLD document stated that the need for PRS resulted from threats to Galileo from "economic terrorists, malcontents, subversives, or hostile agencies which

[54] Brachet and Deloffe, "Space for Defense," section 3.2.
[55] Fritz Merkle, "The SAR-LUPE Program: An Industrial View," (paper presented at the conference on "Security and Defense Aspects of Space: The Challenges for the EU," Athens, Greece, May 9, 2003. http://directory.eoportal.org/presentations/6898/8343.html (accessed November 10, 2007).

could result in damage to national security, law enforcement, safety or economic activity."[56] It went on to say that PRS would use appropriate interference mitigation technologies and improve the probability of continuous availability of Galileo's most accurate signals in the presence of interfering threats, "to those users with such a need." Such users were listed as: Law enforcement (EUROPOL, Customs, European Anti-Fraud Office); Security Services (Maritime Safety Agency) or Emergency Services (peacekeeping forces, or humanitarian intervention); and Intelligence services.

Thus, the only reference to possible military users of PRS was in the context of peacekeeping and humanitarian intervention. In addition, as discussed earlier, the United States viewed Galileo's planned PRS capabilities as undermining U.S. GPS NAVWAR plans and as a strategy to provide Europe with leverage over the operation of GPS.

In another thread, the coupling of Europe's space activities with European Union broader policy interests continued to grow tighter. On 2 March 2001 the ESA/EC Joint Task Force (JTF) was established to implement the *European Strategy for Space*, as endorsed by the European Research Council and the ESA Council at Ministerial level on 16 November 2000.[57] The JTF's first priority was to thoroughly analyze the Galileo project's current situation.

Meanwhile, on 15 March 2001 a Memorandum of Understanding was signed between the EC and a group of industrialists, including players from space service providers, operators, equipment suppliers, and space system manufacturers.[58] This memorandum envisioned 200 million euros in private funding for the Galileo

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[56] EC and ESA, "Galileo: Mission High-Level Document," September 23, 2002, 17.
[57] ESA, "ESA-EC Joint Task Force on European Strategy for Space Meets for the First Time in Brussels," March 2, 2001. http://www.esa.int/esaCP/ESAG25UM5JC_index_2.html (accessed January 7, 2008).
[58] ESA, "Galileo: the European Commission Mobilizes Euros 200 Million in funding," IP/01/431, Brussels, March 22, 2001.

Development Phase. The Memorandum of Understanding was considered a sign that the private sector was willing to commit financially to the Galileo project beginning with the Development Phase, rather than with the Deployment Phase as envisioned in the November 2000 EC report wrapping up the Definition Phase. Nevertheless, decision-makers in Britain and German and other skeptical governments[59] weren't convinced of industry's commitment and wanted a better cost-benefit analysis of the Galileo project. For their part, the industrialists expected a clear political decision on the launch of the project at the Transport Council meeting in April. It was agreed that the parties to the memorandum would meet again in June to confirm the private funding after the necessary political decisions had been made.

However, on 5 April 2001 the Transport Council identified fundamental issues that still had to be resolved in 2001 including: the setting up of political control of Galileo on an appropriate legal basis; Galileo's objectives and mission requirements; Galileo's interoperability with GPS and GLONASS; the development of long term commitments from the private sector; the level of system security required; Galileo's integration with EGNOS; and third party involvement.[60] The key question that still needed to be resolved was how private sector funding of the Deployment Phase would come together. The Transport Council wanted the private sector to make binding commitments to fund the majority of the Deployment Phase and stated clearly that private participation and

[59] Sweden, Denmark, Austria, The Netherlands. Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 196.
[60] ESA, "Galileo forges Ahead With the Release of Funds," *ESA*, April 17, 2001. http://www.esa.int/esaCP/ESAM1PGBCLC_index_2.html (accessed January 7, 2008).

funding was a fundamental element for the success of the Galileo program.[61] The future of the Galileo program depended on it.[62]

However, the Transport Council did adopt a resolution which released 100 million euros in order for a "request for proposals" to be announced and for Galileo development work to begin.[63] Nonetheless, this was not considered the official start of the Development Phase. In fact, the Transport Ministers did not release the other 450 million euros the EU had budgeted for the Development Phase. They announced that they would decide on the release of the other 450 million euros for the Development Phase at their meeting in December 2001. In addition, they announced that they would also decide in December on the set up of the entity that would manage the program.[64]

At this time, key states softened their positions on the question of Galileo's military uses versus its commercial uses. France, Italy, and Spain reduced their emphasis on Galileo's military potential and agreed that Galileo would be used *strictly* for civilian purposes under civilian control. In return, Germany reduced its demands for the private sector to play a more prominent role in the early stages of Galileo.[65] These moves seem to indicate that realist factors were taking a back seat to liberal factors, but a more skeptical perspective may view these moves as simply politically expedient decisions made in order to move the project forward despite legitimate questions about the project's purpose, who was going to control it, and how it was going to be financed.

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[61] Council of the European Union, "Council Resolution of 5 April 2001 on Galileo," (2001/C 157/01), *Official Journal of the European Union*, (Brussels: EU April 30, 2001).
[62] European Commission, *White Paper: European Transport Policy*, 95.
[63] "The European Transport Ministers Have Approved a Program to Develop the Galileo Satellite Navigation System," *Aviation Week and Space Technology*, 154, no. 15 (April 9, 2001): 27. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=71431931&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD. (accessed January 8, 2008).
[64] Commission of the European Communities, *Proposal for a Council Regulation on the Establishment of the Galileo Joint Undertaking*, COM (2001) 336 final (Brussels: EC, June 20, 2001), 3.
[65] Lembke, *The Politics of Galileo*, 31.

Therefore, it is necessary to continue to examine the broader context of what was happening in Europe and not just consider Galileo in isolation.

In this regard, another ESDP "Capabilities Conference" was held on 19 May 2001 to discuss the EU Military Committee's evaluation of European military capabilities and shortfalls. This conference established project groups, each led by a "lead nation," for the purpose of implementing concrete projects to fill European military capability gaps. France led the "space" project group and it found, unsurprisingly, that Galileo's capabilities cut across numerous areas of need, from the need for better C3I, to better situational awareness, to more precision weapons capability.[66]

On 15 June 2001 the EC Directorate General Enterprise released a report on space industry developments in 2000.[67] The report noted that there had been a slow-down in the requirement for satellites and launcher systems and that the international investment community's confidence had been compromised. Optimistic forecasts on the rapid growth of the commercial space sector were failing to materialize. This did not portent well for Galileo since the ability of largely private interests to develop and finance Galileo was to be a central factor in deciding the future phases of the project. On the other hand, it made the Galileo project that much more important as a source of business for the space industry.

On 20 June 2001 the European Commission presented its proposal for the European Council to establish the "Galileo Joint Undertaking" (GJU) as the single

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[66] Burkard Schmitt, *European Capabilities Action Plan (ECAP)* (Paris: European Union Institute for Security Studies, 2005). http://www.iss.europa.eu/index.php?id=185&tx_ttnews[pointer]=4&cHash=b3155bc7ac (accessed June 14, 2007).

[67] European Commission, *Space Industry Developments in 2000*, (Brussels: European Commission, June 15, 2001), 10.

management structure for Galileo's Development Phase.[68] Its two main tasks were to oversee implementation of the Development Phase by combing private and public sector funding and to prepare for the subsequent phases of the program. Funding for its activities was to come from ESA, the EC Transport budget and Research budgets, and private interests. Organizationally it was to be comprised of an Executive Committee, a Director, and Administrative Board. The Executive Committee was composed of a representative from the EC, ESA, and a representative of the private sector, selected from among Administrative Board members. The Administrative Board was composed of all members of the GJU and made decisions on programming and financial and budgetary manners. There was no military or defense official involvement in the GJU.

Then the terrorist attacks on the United States on 11 September 2001 changed the global security situation quite suddenly. The United States' vast military power rolled into action in the retaliatory invasion of Afghanistan in October of 2001. GPS and other space-based military assets again demonstrated their ability to enable U.S. power projection capabilities.

On 15 October 2001 European Research Commissioner Busquin said that Europe must ensure it had the means to intervene militarily on an international scale. His spokesperson said that while the EC's Galileo and GMES projects were civilian initiatives, the military use of Galileo and GMES data could not be ruled out if the need arose.[69] According to Busquin a clearer definition of the potential security role of GMES and Galileo was needed to distinguish between "defense missions" and "security

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[68] Commission, "Proposal for a Council Regulation."

[69] Cordis, "Busquin Clarifies "Security" Role of GMES," October 16, 2001. http://cordis.europa.eu/search/index.cfm?fuseaction=news.document&N_LANG=EN&N_RCN=17489&q=F75E279188B23AF2D386E120340137F1&type=hom (accessed August 3, 2007).

missions" (as in human and environmental security). In this regard, he met with Javier Solana, the EU High Representative for Common Foreign and Security Policy, to discuss clarifying the link between the EC concept of security and the CFSP's military-oriented concept of security.

Meanwhile in October during EU – U.S. talks over GPS and Galileo, the EU provided the first substantive presentation of Galileo's proposed frequency spectrum plan.[70] The United States found the proposed Galileo spectrum plan unacceptable due to the GPS military signal overlay issues (discussed earlier). Discussions broke off when an impasse was reached on this issue. The United States responded with a series of high-level letters and demarches, described below.

Throughout the summer and fall of 2001 ESA had worked on Galileo satellite and ground segment technology. On 15 November 2001 the Edinburgh ESA Ministerial Council approved the next phase of the GalileoSat development program with a budget of 550 million euros, subject to the expected approval of the Development Phase by the Transport Council of the European Union in December 2001.[71]

Also on 15 November the U.S. State Department's chief negotiator for Galileo-GPS coordination sent a letter to DG TREN's chief negotiator, DG TREN's manager for land transport, saying that the United States would not accept the overlay of Galileo's PRS signal over the GPS military signal. The letter also pointed out that NATO

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[70] Ralph Braibanti, Jason Y. Kim and Damon Wells, "GPS-Galileo Negotiations: Commercial Issues at Stake," (briefing to ISAC-1, April 25, 2002), slide 7. http://www.space.commerce.gov/library/speeches/2002-04-24-ISAC-briefing.ppt#276,7,Status of Negotiations. (accessed February 15, 2008). Also see, Taverna, "Europe Declares Satnav Independence."

[71] "Resolution on the Agency's Programmes (Adopted on 15 November 2001)," *Space Policy* 18 (2002): 83. Also see Andrew Wilson, ed., "Galileo Programme," in *Galileo, First European Navigation Satellites*," (AG Noordwijk, The Netherlands: ESA Publications Division, 2005), 19.

supported this U.S. position.[72] However, nothing seemed to come from this warning shot.

Shortly after, on 20 November 2001, the Executive Summary of a closely-guarded PricewaterhouseCooper study was released and became the main point of reference for both Galileo skeptics and supporters. The PricewaterhouseCooper study was sensitive because many states had anxiously awaited this report and were expected to base their decisions on Galileo on the findings of this study. Earlier in 2001 the EC had commissioned the private consultancy firm to investigate the development of a business plan for Galileo and to do a thorough, independent cost-benefit analysis of the project based upon the Galileo Mission High Level Definition document. The report estimated the cost of the project to be 200 million euros more than the EC had estimated earlier. But it also estimated that Galileo would also generate significantly more revenue than the EC had projected.[73] But again, direct revenues alone could not justify the project due to the economics of the project. Nevertheless, the study found that the broader benefit to the European economy would be significant.[74] With that, it noted that there was a strong case for the public sector to promote Galileo.

With regard to the Galileo PPP, the report stressed that any PPP needed to ensure that Galileo was operational by 2008 in order to get in the PNT market before the window of opportunity was closed by the launch of GPS III.

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[72] Peter B. de Selding, "Galileo Supporters Hopeful for March Funding Decision," *Space News*, 7 January 2002, 5.

[73] The study estimated 3.4 billion euros versus the EC's estimate of 3.25 billion euros to develop and deploy Galileo. See Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 194. Also see The Economist, "Eppur si Muove--or Maybe Not," *The Economist*, May 22, 2002.

[74] PricewaterhouseCooper, *Inception Study to Support the Development of a Business Plan for the Galileo Programme, TREN/B5/23-2001, Executive Summary,* prepared at the request of the EC, November 20, 2001, 8.

Meanwhile, the United States was still reeling from the attacks of 11 September the anthrax attacks of October and November 2001, and ongoing battles in Afghanistan. Unexpectedly, on 4 December 2001, U.S. Deputy Secretary of Defense Paul Wolfowitz sent a letter to all the European NATO defense ministers warning the European Union not to proceed with Galileo and that the decision should not belong solely to research and transport ministers.[75] He expressed his "concerns about security ramifications for future NATO operations if the European Union proceeds with Galileo satellite navigation services that would overlay spectrum of the [GPS] military M-code signals." He requested that the European defense ministers pass the message to the transport ministers who would be deciding the fate of Galileo. According to Wolfowitz, interference from Galileo signals threatened the military capabilities of the GPS system, and Galileo could be abused by future adversaries causing harm the United States.

European decision-makers viewed this as an overt attempt by the United States to undermine European support for Galileo and resented the American interference. Some observers argued that the U.S. pressure would backfire and just make European leaders all the more aware of Galileo's strategic importance.

Nevertheless, when the European Transport Council met on 7 December 2001 it was unable to make a decision on the fate of Galileo and did not indicate when, or if, it would discuss the subject again.[76] The fundamental differences over financing and

[75] Logsdon, "A Security Space Capability for Europe?" 275.
[76] Peter B. de Selding, "European Action Leaves Galileo Program in Limbo," Space News, 10 December 2001.

control of Galileo that had been dogging Galileo from the start remained unresolved.[77] The Galileo program was nearly dead.

First, the feasibility of a PPP was in grave doubt. Many believed that there was no real prospect of attracting significant early private funding due to two main reasons; GPS was available for free, and any revenue generated by Galileo was many years away.[78] Attracting significant private investment in such an uncertain environment was doubtful.[79] Nevertheless, Britain and Germany insisted that Galileo was, above all, a business opportunity and should be substantially financed and controlled by private interests from an early stage. Germany's transport minister was particularly concerned about the prospects for attracting private funding and wanted more time to study the issue.[80]

Second, Member States' willingness to sink the required amount of money into the publicly financed portion of the project was also in doubt. France and Italy thought of Galileo in more strategic terms and thought that its Development Phase and Deployment Phase should be fully publicly funded without a detailed cost analysis. Once Galileo reached the Operational Phase, private investment would be welcomed. However, it was difficult for many states politically to commit to spending billions of taxpayer dollars in order to build a redundant (to GPS) system. The skeptical countries, led by Germany and the United Kingdom, also wanted more time to study this issue. Questions also remained about the return on investment of public moneys and on whether

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[77] "December is Make or Break Month for Galileo," *Global Positioning and Navigation News*, November 14, 2001. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=89860629&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD. (accessed January 8, 2008).
[78] Global Positioning and Navigation News, "December is Make or Break Month for Galileo."
[79] Peter B. de Selding, "Galileo Supporters" *7* January 2002, 5.
[80] Peter B. de Selding, "Galileo Supporters," *Space News*, 7 January 2002. In addition, Sweden, The Netherlands, and Austria had reservations and wanted additional time to consider Galileo's feasibility. See "Germany to ratify Galileo System," *Aviation Week and Space Technology*, 156, no. 9 (March 4, 2002): 4.

or not users would have to pay for access to the system, and if so, how that would affect Galileo's ability to compete with GPS.

Clearly, there were splits between various European decision-makers' assessments of the need for Galileo. It is reasonble to argue that one side, led by France and Italy, considered realist factors more heavily. The other side, led by Britain and Germany, considered liberal factors more heavily. This split appeared to create irresolvable differences over the objectives of the Galileo program and in turn, its organization and its funding. A stalemate had developed and it appeared as if Galileo was facing termination. The only way to move forward was for a consensus to develop around which factors were more important, "realist" strategic considerations or "liberal" commercial considerations.

Immediately, advocates of Galileo from many arenas made their case for Galileo. The Joint Task Force established between ESA and the EC Directorate General for Research had been analyzing the Galileo project as its first priority. On 7 December 2001 the EC released its findings in an EC communication to the European Council and European Parliament entitled, *Towards a European Space Policy*. It presented Galileo as a key component of future EU space initiatives. On 10 December the European Council ratified the conclusions of the document.

On 11 December the EC President at the time, Romano Prodi, gave a state of the union address to the European Parliament and decried the European Transport Council's indecision. Likewise, the Directorate-General for Transport and Energy, EC Vice-

President Loyola de Palacio, threatened to kill the Galileo project unless unambiguous approval came soon.[81]

Of course the aerospace industry made its position clear as well. On 13 December the European Association of Aerospace Industries (AECMA) and Eurospace (the association of the European space industry) issued a joint press release. It stated that further delay created a strong shortfall in the European aerospace industry. It also stressed that the commercial projections for Galileo were closely linked to timeliness and fast access to market and that "Further delay may severely impair the present economic rationale of the system."[82] In addition, the conflict between realist factors and liberal factors are illustrated by this statement. It said:

> The Galileo program is vital for European independence in transport management as well as telecommunications (network synchronization, mobility, …), security, and a wide range of applications that will otherwise still depend on GPS. This strong strategic dimension is complemented by commercial and economic benefits to accrue with the development of downstream added value services and applications.[83]

Meanwhile, the European Parliament presented a letter (signed by 160 members) to the European Council calling on the Heads of State to overcome the Transport Council of Ministers differences in order to approve Galileo without further delay.[84]

On 15 December the European Council in Laeken, Belgium, approved a statement which confirmed the strategic importance of Galileo and called on the European Transport Council to consider the report by PricewaterhouseCooper and decide on the

[81] "Galileo on the Brink: Delay Builds Tensions," *Galileo's World*, January 1, 2002. http://uc.gpsworld.com/gpsuc/Timing/Inside-the-Community---Jan-2002/ArticleStandard/Article/detail/308338 (accessed January 15, 2008).
For an overview of EC Vice-President Loyola de Palacio controversial management style see Peter B. de Selding, "Galileo Supporters," *Space News*, January 7, 2002, 5.
[82] AECMA and Eurospace Joint Press Release, "Galileo: The Urgent Need for a Positive Decision," (Brussels: AECMA, December 2001). http://www.aecma.org/Press/pr0111.htm (accessed April 27, 2006)
[83] AECMA and Eurospace, Joint Press Release, "Galileo: The Urgent Need."
[84] Galileo's World, "Galileo on the Brink."

funding of the Development Phase by March 2002. The European Council also applauded ESA's decision to fund Galileo's Development Phase for 550 million euros.

On 17 December EC President Prodi gave another speech at the European Parliament in which he stressed the strategic importance of Galileo and its importance as a catalyst for innovation and competitiveness. He also noted that the credibility of the Transport Council and European Council was at stake, especially since ESA had already committed 550 million euros, and the European Council had just endorsed the ESA/EC Joint Task Force finding on the importance of Galileo to Europe's future.

Also on 17 December demonstrating the EC's will to move forward while the European Transport Council worked out its differences, DG TREN released 70 million euros to continue work on Galileo. These Trans-European Network Funds were part of the 100 million euros which had been approved by the Transport Council in its April 2001 decision.

In addition, DG TREN released a position paper in December which went outside its area of competence but nevertheless pointed out that if the Galileo program was abandoned, within 20 to 30 years Europe would lose its autonomy in defense.[85] This was due to the fact that virtually every new military capability other than small arms used navigation satellite technology. Therefore, without control over its own navigation satellite system, European military power would be reliant on outside powers' capabilities.

So by 18 December 2001, the European Council had confirmed its support for Galileo; the European Parliament had expressed its support for Galileo; the EC was

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[85] James Hasik and Michael Rip, "An Evaluation of the Military Benefits of the Galileo System," *GPS World* (April 1, 2003). http://www.gpsworld.com/gpsworld/article/articleDetail.jsp?id=53279 (accessed January 15, 2008).

moving forward with development; industry had firmly stated its support for Galileo; and March 2002 had been established as the next Transport Council Galileo decision point. Despite the Transport Council's lack of a decision just 11 days earlier, it appeared possible that Europe might recover the momentum to move Galileo forward. It was then that key European leaders turned their attention to the perceived interference by the United States.

EC Vice-President de Palacio, the Director-General for Transport and Energy, spoke in Madrid on 18 December and condemned American pressure on EU governments. Likewise on 18 December French President Jacques Chirac made widely reported remarks at the 40th anniversary of the founding of CNES. President Chirac stated that "The United States spends six times more public money on the space sector than Europe. Failure to react would inevitably lead to our countries becoming first scientific and technological vassals, then industrial and economic vassals."[86] He also said that Galileo had strategic importance for the ESDP and the EU Rapid Reaction Force.

Chirac's "vassals" remarks caught a lot of attention but a closer analysis shows that they mirrored the 1960s French rationales for the creation of CNES and were a further statement of French concern about the technology gap with the United States.[87] There really wasn't that much new in them, but they caused a stir since in this case they were stated bluntly by the French President after the United States had overtly tried to stop Galileo, a major European space endeavor.

On 31 December 2001, DG TREN released a document "Galileo: An Imperative for Europe." It stated "There are two "strategic" elements of the Galileo programme

[86] Financial Times,"Chirac Urges More Spending on Space Sector," FT, December 19, 2001.
[87] Also see Johnson-Freese, *Space as a Strategic Asset*, 9.

which are of the ***utmost*** importance to the Member States which have ***not*** been highlighted in the various documents published to date."[88] (Emphasis added) Then this EC document publicly acknowledged that Galileo was indispensable for European military forces to maintain autonomy. Likewise, Galileo was essential for European arms exports since virtually all future weapons systems would otherwise have GPS embedded within them. In addition, this document stated that the Wolfowitz letter left the impression that America's main purpose was "to safeguard the world monopoly on secure navigation services which is held by the United States."

The 1 January 2002 issue of *Galileo's World* quoted an anonymous consultant deeply engaged in the Galileo program. He also confirmed the perception that the U.S. Defense Department's intervention may have increased European support for Galileo rather than reduce it: "The fact that the U.S. brought pressure to bear on the European governments just before the last Council had certainly the reverse effect, that is to confirm to the European Governments the strategic interest of Galileo and, therefore, a strong need for political support at the highest level."[89] It also appears that the American interference may have stimulated an "us versus them" response in European decision-makers' minds and united them in their determination to press ahead. In this respect, Galileo was perhaps becoming an even more substantial symbol of European pride, prestige, and identity.

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[88] EC Directorate-General Energy and Transport, "Galileo: An Imperative for Europe" *Information Note*, (Brussels, EC, December 31, 2001), 8.
[89] Galileo's World, "Galileo on the Brink." Also, Volker Liebig, the then director of DLR operations, expressed similar thoughts to me in a March 2004 interview in which he said that the more the United States resists Galileo, the more united Europe will become in their determination to see it through, as happened with the Ariane launch vehicle in the 1970s.

Also on 1 January 2002 the European Union absorbed the Western European Union Satellite Center. The renamed EU Satellite Center's purpose was to support ESDP decision-making, especially in crisis management operations. Although this takeover represented only a minor increase in EU military space capabilities, it was a further indicator that realist factors were increasingly influencing European decision-makers' assessments of the need for such capabilities.

Later in January, the European Union released a background paper on Galileo in which it stated that U.S. arguments that GPS was free and therefore superior to Galileo were spurious.[90] It said that while the future GPS might offer high-quality services to match those of Galileo, there was no guarantee that the United States would provide them for free, especially if GPS continued to be in a monopoly position. It also said that the United States should trust the EU's ability to keep Galileo PRS signals secure from malicious use. The EU did concede, however, that American concerns over signal interference were legitimate and ought to be considered.

Later in January 2002, the European Parliament presented a report which favored Galileo strongly. The *Glante Report* of 10 January 2002 said that the next generation GPS III was expected to be operational by 2010 and if Galileo became operational after that there was a risk Galileo would be redundant. "This would put an end to any hopes of a non-military satellite system" it stated.[91] It also recommended a change in the PPP management structure. Interestingly, the Greek delegation proposed a motion restricting

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[90] Agence France-Presse, "US Steps Up Offensive Against European Rival to GPS," *AFP*, March 7, 2002.
[91] European Parliament, "*Report on the Proposal for a Council Regulation on the Establishment of the Galileo Joint Undertaking*," Final A5-0005/2002, Rapporteur, Norbert Glante (January 10, 2002), 32.

EU space activities to civil uses only, but that motion was struck down.[92] However, Britain insisted that all public statements about Galileo should stress its civilian applications.[93]

In February 2002 senior European military officers came out of the shadows and for the first time openly backed the Galileo system and tried to convince Transport Ministers of Galileo's strategic importance. The head of the space bureau of the French General Staff, Gen. Daniel Gavoty, said senior military offices from France, Italy, Spain and other countries had begun an "arm-twisting campaign" aimed at Transport Ministers.[94] Apparently, European military brass had belatedly recognized the negative affect that a vote against Galileo would have on European defense cooperation. Thus, senior European military officials expressed themselves in favor of Galileo, rather than against Galileo, as U.S. Deputy Secretary of Defense Paul Wolfowitz had tried to pressure them to do in December.

At the beginning March 2002 German decision-makers dropped their objections and announced that Germany would support Galileo. This virtually assured the Galileo's approval at the Transport Council meeting later in March, although the United Kingdom's position was still unknown. It is difficult to say why Germany dropped its objections, but since questions concerning Galileo's commercial viability and the feasibility of private financing remained mostly unanswered, it is reasonable to argue that the overt military pressure now being applied to the transport ministers was a

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[92] Aviation Week & Space Technology, "Military Pushes for Galileo," *Aviation Week & Space Technology* 156, no. 7 (February 2002): 28. http://proquest.umi.com.proxygw.wrlc.org/pqdlink?PMID=28974&TS=1223529386&SrchMode=3&SrtM=0&PCID=1618625&VType=PQD&VInst=PROD&aid=1&clientId=31812&RQT=572&VName=PQD&firstIndex=40 (accessed February 15, 2008).
[93] The Economist, "Eppur si muove—or maybe not."
[94] Aviation Week & Space Technology, "Military Pushes for Galileo," 28.

contributing factor. In addition, the concept of "European non-dependence" had solidified over the preceding months and contributed to the European position on Galileo.[95]

In a letter to the European Union on 6 March 2002 the U.S. Defense Department reiterated the concerns that Deputy Secretary of Defense Wolfowitz had expressed in his December letter to NATO defense ministers.[96] In addition, on 7 March the U.S. State Department stepped up its diplomatic offensive against Galileo when the State Department released a statement on GPS and Galileo. It said that the United States saw "no compelling need for Galileo" and emphasized three concerns: trade-related, technical, and security.[97] On trade, it declared that the United States was against any restrictions on access to information on Galileo that may be needed by non-European companies to build Galileo related equipment and participate in service markets. It also underlined that the United States was opposed to any regulations or standards that would mandate the use of Galileo at the expense of GPS manufacturers. Regarding technical and security concerns, the United States stated that it would be "unacceptable" for Galileo to overlay the GPS military frequency, and that the United States would "oppose" anything that that would degrade GPS signals, diminish the ability to deny access to GPS signals in time of crisis (i.e. NAVWAR techniques), or "undermine" NATO cohesion. This was a clear statement that the United States viewed Galileo as a threat to its military capabilities.

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[95] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 197.
[96] Taverna, "Europe Declares Satnav Independence."
[97] U.S. Department of State, Office of the Spokesman, "U.S. Global Positioning System and European Galileo System," Media Note, Washington DC, March 7, 2002. http://www.state.gov/r/pa/prs/ps/2002/8673.htm (accessed January 23, 2008).

Europeans rejected these pressure tactics on 12 March when the EC Directorate-General for Transport and Energy responded sharply in a statement saying, “It is crucial for Europe… to not remain dependent on the current monopoly of the American GPS system which is less advanced, less efficient, and less reliable.”[98]

The European Council met on 15 - 16 March in Barcelona, welcomed progress on Galileo, and asked the Transport Council to “take the necessary decision” to fund Galileo’s Development Phase at its upcoming meeting on 25 – 26 March 25 in Brussels.[99] But even then the United States kept the pressure on and restated its opposition to Galileo at a NATO meeting on 20 March.[100]

Nevertheless, on 26 March 2002 the Transport Council in a unanimous decision finally gave a clear go-ahead to the Development Phase of Galileo. Even the United Kingdom, although still skeptical, dropped its opposition when it realized that there was no longer a blocking minority under the Transport Council’s qualified majority voting rules.[101] Pressured by the European Council, the European Parliament, the European Commission, industry, and top national military officers, the Transport Council overcame doubts about Galileo’s management and financing, ignored the United State’s objections, and released the European Union’s share of the funding for Galileo’s full-scale

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[98] Peter Warner, “After Much Debate, UK Government Commits to Galileo,” *Satellite News*, April 8, 2002. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pqdweb?did=113043359&sid=1&Fmt=3&clientld=31812&RQT=309&VName=PQD (accessed January 8, 2008).
[99] ESA, “ESA Welcomes Conclusions of the Barcelona European Council on Galileo,” March, 2002. http://esa.int/esaCP/ESA3YFT7YYC_INDEX_2.html (accessed January 7, 2008).
[100] Taverna, “Europe Declares Satnav Independence.”
[101] Suzuki, *Policy Logics and Institutions of European Space Collaboration*, 197. On qualified majority voting, see Vidal Ashkenazi, “Galileo Friend or Foe?” (presentation given to Interagency GPS Executive Board, Washington DC, February 28, 2002).

development.[102] In the enthusiasm of the moment, the French Transport Minister declared that Galileo was at least as important as the Ariane and Airbus projects.[103] Supporters at the EC and ESA and other Galileo enthusiasts felt the same way.[104]

The Transport Council also asked the EC and ESA: to establish the "Galileo Joint Undertaking" to manage the Development Phase; to establish a Galileo Security Board in 2002; and to negotiate with the United States to make GPS and Galileo interoperable.

In its 26 March 2002 press release the Transport Council reaffirmed that Galileo was a civil system under civil control. However, also on 26 March, DG TREN released an unusually blunt "Information Note" which made clear that Galileo would "underpin" the common European defense policy and stated candidly that Galileo would give the EU a military capability.[105] Furthermore, it stated that Galileo would "put an end" to a situation of [security] dependence on the United States. Moreover, it said that the EU would be "impotent" without its own satellite navigation system. Numerous other comments throughout this document border on vitriol toward the United States and GPS.

2. Findings:

Conflicting indicators muddle the findings at the 2002 decision point. On one hand, the evidence shows that realist factors weighed heavily on European decision-makers' minds and possibly were the most important factor in their approval for Galileo

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[102] "2420th Council Meeting: Transport and Telecommunication," 7882/02, Presse 78, Brussels, March 26, 2002.
[103] Michael A. Taverna, "Europe Declares Satnav Independence."
[104] Lembke, "EU Critical Infrastructure," 58.
[105] Commission of the European Communities, Directorate-General for Energy and Transport, *Galileo: The European Project on Radio Navigation by Satellite: Information Note*, March 26, 2002, 4. http://ec.europa.eu/dgs/energy_transport/galileo/doc/galileo_info_note_2002_03_26_en.pdf (accessed January 8, 2008).

to go forward. On the other hand, there is considerable evidence that liberal factors were also very significant. Ideational factors were present, but relatively the least important.

Hypothesis A: Realist factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.

I do **not** reject Hypothesis A due to several indicators suggesting that realist factors weighed significantly more heavily on European decision-makers' assessments of the need for Galileo in 2002 than at the time of the July 1999 decision. Bear in mind that European Transport Ministers' refused to allow Galileo to go forward at three different points in the Definition Phase (December 2000, April 2001, and December 2001), essentially due to a stalemate over the primary purpose of Galileo. France and Italy desired Galileo's capabilities more for strategic "realist" reasons and were not so worried about private financing and a detailed cost analysis. In contrast, Britain and Germany desired Galileo for more liberal "commercial" reasons, and insisted upon private financing from an early stage, and wanted a detailed cost-benefit analysis.

Recall that the 19 July 1999 Council of the European Union resolution which approved Galileo's Definition Phase stated that it expected the EC and Member States to take measures to ensure that largely private interests would develop and finance Galileo. It stated that meeting this requirement was a central factor in deciding on future phases of the project. However, it appears that the stalemate over Galileo's future was only resolved when a consensus developed in early 2002 around the more strategic "realist"

reasons for Galileo. European decision-makers set aside concerns about Galileo's management and financing so Galileo's development could proceed.

However, the picture is not entirely clear, due to the continued civil and commercial nature of the organizations managing the project, providing funding for the project, and with the most control over the project. Nevertheless, the tone of the rhetoric, official expressions of policy, and actions of European decision-makers took on increasingly more realist overtones during the course of the Definition Phase. The indicators discussed below reveal that realist factors had a growing influence on European decision-makers.

As discussed previously, the events of the late 1990s caused Europe to realize that it had a role and responsibility in helping to maintain international order. Europe began work on the ESDP, including the development of greater EU defense cooperation and the development of EU military capabilities, simultaneously with the start of the Galileo Definition Phase. The European Capabilities Action Plan and other reports discussed above noted that space capabilities, including dual-use space capabilities, were vital enablers of future EU military capabilities. Likewise, the EU absorbed the WEU Satellite Center and acknowledged the military usefulness of GMES and Galileo. These activities indicate that, overall, realist factors were becoming more prominent in European decision-makers' assessment of European space activities.

In addition, the EC/ESA joint *European Strategy for Space* linked Europe's space activities to the political, economic, and security policy objectives of the European Union. In turn, this linked ESA activities to EU policy and opened the door to a closer relationship between ESA and the EC.

Similarly, ESA's "Wise Men" report cracked the door open for ESA to engage in EU defense and military projects, as long as they were for the development of capabilities which were of a "non-aggressive" nature, such as peacekeeping or crisis management.

In addition, European states with the capacity to engage in space activities unilaterally or multilaterally at the national level began to increase their military space capabilities. Germany, France, the United Kingdom, and Italy, as well as up and coming Spain, began military telecommunication and Earth observation satellite programs during the timeframe encapsulated within Galileo's Definition Phase.

With regard to the relationship between GPS and Galileo, a number of U.S. actions were seen as unfriendly attempts by the United States to undermine the Galileo project, including: the U.S. decision to turn off Selective Availability in May of 2000; U.S. opposition to the EU's frequency spectrum request at the WRC in May 2000; U.S. acceleration of GPS modernization; and the U.S. Defense Department's opposition to Galileo and the overt attempt to influence European decision-makers. Additionally, while acknowledging that the PRS/GPS military signal overlay issue was a legitimate matter for discussion, the EU felt that intense U.S. pressure over the issue was unwarranted due to the fact that the WRC had approved the EU's request.

Finally, an increasingly unilateralist bent to American foreign policy caused European decision-makers to acknowledge that the EU might someday wish to undertake military missions that the United States did not consider to be in its interests. This realization forced European decision-makers to more seriously consider Galileo's military potential and its importance to closer European defense cooperation. In this way, the U.S. actions may have helped "realist" factors achieve the critical mass to

overcome European decision-makers' concerns about Galileo's management and financing.

Finally, rhetoric and official statements and reports definitely showed an increasing stress on "non-dependence" (i.e. autonomy), Galileo's military utility, and Galileo's "strategic" importance to Europe, while de-emphasizing the importance of private financing. While such statements are not considered strong indicators of the presence of realist factors in and of themselves, the combination of the other indicators above, including pressure from European Heads of States and Governments and the "arm-twisting" of transport ministers by top military officials in early 2002, makes it reasonable to state that realist factors were the primary influence in European decision-maker's assessments of the need for Galileo.

However, such a judgment can not be completely conclusive. After all, military and defense officials did not have control over Galileo's development, they were not included in its management, and they did not contribute financially to the Galileo program. In addition, it is possible that decision-makers were driven in early 2002 mostly by the desire to get Galileo launched in time to capture market share before GPS III was launched. However, this motive did not seem to heavily influence their decisions at the three earlier opportunities in which they declined to approve the start of Galileo's Development Phase.

In sum, there is sufficient evidence and logic to conclude that realist factors most likely weighed the most heavily on European decision-makers' assessments of the need for Galileo at this point in time.

Hypothesis B: Liberal factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.

I reject Hypothesis B due to the fact that the European Council as well as top European military officials interposed themselves into the European Transport Council's decision to approve Galileo's Definition Phase. The Transport Council was unable to approve the start of Galileo's Development Phase in December 2000, April 2001, and December 2001 due to the emphasis on private financing and the PPP management structure. The obstacles caused by the question of private financing were only overcome after the Transport Council came under pressure from the European Council (Heads of State or Governments), and national level military leaders whom stressed the strategic importance of Galileo and its importance to European defense cooperation.

However, there are plenty of indicators that liberal factors still carried significant weight. Galileo's funding still came from civil sources (i.e DG TREN's TEN budget and ESA's budget), private financing was still planned for the Deployment and Operational Phases, and the Galileo project was still managed and controlled by civilian authorities. In fact, the need for European military officials to twist the arms of European transport ministers shows that up until that point at least, military officials had little influence over Galileo decisions.

Nevertheless there is sufficient evidence to conclude that liberal factors did not weigh the most heavily on European decision-makers' assessments of the need for Galileo. Liberal factors were most likely significant intervening variables which affected the decision-makers assessments, but did not weigh the most.

Hypothesis C: Ideational factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.

I reject Hypothesis C due to a lack of evidence. Ideational concerns were more significant than in the approval of the Definition Phase, but relative to realist and liberal factors they weighed the least.

Nevertheless, the strong American opposition to Galileo seemed to affect European's pride and possibly inspired a stronger sense of "European" identity among European decision-makers. In addition, the idea of "non-dependence" took on more weight in early 2002, and the 26 March 2002 DG TREN "Information Note" on Galileo had hints of anti-Americanism in its tone. Nonetheless these factors did not outweigh the realist and liberal factors already discussed.

Levels of Analysis: It is important to point out that Germany's decision to change its position to align closer to France and Italy was what broke the deadlock in the European Transport Council and allowed Galileo to enter the Development Phase. A more detailed investigation of what caused Germany to flip its position would help complete the picture of what happened in the run up to the 26 March European Transport Council meeting but was beyond the scope of this study. However, this topic should be investigated by future researchers.

It is also important to emphasize that the United Kingdom only went along with the decision because after Germany's change of position, it could no longer block the

decision under the EC's qualified majority voting rules. Although Galileo was allowed to go forward into development, serious questions remained about its primary purpose, private financing, and the feasibility of making it a PPP. The United Kingdom firmly maintained its position that Galileo was for civil purposes under civil control and that it should be structured as a PPP with the majority of its funding coming from private sources.

Consideration of these aspects of events shows that national level concerns were sometimes able to block progress in the Galileo program but not always. Hence it is reasonable to argue that the international level, that is the European Union acting "as if" it was a state at the international level, was the relatively more significant level behind the approval of the Development Phase.

As with the decision to enter the Definition Phase, Galileo cannot be properly considered outside the context of its relationship to GPS and Europe's collective relationship with the United States. Therefore, the internally oriented European level with it focus on institutional relationships and interactions between DG TREN, Pillar Two, ESA and member states cannot reasonably be considered the relatively most significant source of the drive to approve the Development Phase.

In addition, this study found little evidence to suggest that the industrial level pushed hard for the decision to enter the Development Phase, although it is reasonable to expect that they wanted the lucrative contracts to come from the project.

In sum, the majority of the evidence suggests that the international level was relatively the most influential level in the decision to begin Galileo's Development Phase.

Summary: This chapter found that realist factors came to prominence in European decision-makers' assessments of the need for Galileo after a nearly fatal deadlock developed over whether Galileo's primary purpose was to serve more liberal oriented ends or more realist oriented ends. It is reasonable to argue (although the proof is not definitive) that the shift in the relative weight of the liberal factors and realist factors contributed to the Galileo program's survival. This study also found that the international level continued to matter the most.

Chapter Six:
Coming Together

Chapter Six focuses exclusively upon the decision to make GPS and Galileo interoperable and compatible. Unlike Chapters Four and Five this chapter does not discuss in-depth the context surrounding the Galileo program. Rather, discussion of Galileo's broader context during this portion of the Development Phase is held off until Chapter Seven. This chapter finds that liberal factors at the international level were the most important motivators for European decision-makers to make Galileo compatible and interoperable with GPS. Most importantly, mutual gains were a primary motive for the agreement.

1. Galileo and GPS Negotiations

The EU Transport Council stated in its 26 March 2002 decision that Galileo should be interoperable with GPS and that an EU - U.S. agreement should be negotiated as soon as possible.[1] On 27 March 2002 EC President Prodi said "Galileo will provide much needed and healthy competition in the area of satellite navigation. We are not seeking confrontation [with the United States]. This is about Europe standing on its own feet."[2]

The United States and the EU had held multiple rounds of talks on the topic since 1996 with formal negotiations starting in November 1999 (See Figure 7).

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[1] "2420th Council Meeting," 21.

[2] Global View, "European Ministers Vote Yea: Galileo Gets Funded," *GPS World*, May 2002, 14.

1968	Aerosat U.S. – Europe talks begun.
1974	Aerosat U.S. – Europe agreement.
1978	Aerosat cancelled.
1978	NATO included in GPS technical development.
1993	NATO adopts GPS.
1996	GPS GNSS/EGNOS talks.
1998:	United States offered draft agreement on GPS/EGNOS cooperation.
1998:	EU interest in cooperation on GNSS-2 with U.S. based on EU criteria.
1999:	Galileo project announced. U.S. – Europe negotiations begin.
2000:	U.S. proposal presented "Five principles for cooperation."
May 2001:	EC submitted counter proposal.
October 2001:	Talks broke off over frequency spectrum overlay issues.
March 2002:	Galileo funding approved.
June 2002:	U.S.- EU talks restarted.
September 2003:	First direct U.S. - EU talks over how Galileo could affect U.S. security interests.
November 2003:	EU agreed to move PRS signal.
January 2004:	EU agreed to move Open Service signal away from the GPS III military signal.
	United States and EU agreed that open services would share the same frequency.
June 2004:	Agreement signed.

Figure 7: United States – Europe Navigation Satellite Negotiation History

However, the United States did not seem to take the need to cooperate with the EU on the Galileo project very seriously prior to the Transport Council's March 2002 decision. Apparently this was because the United States did not think that Europe would be able to get its act together and actually agree to fund the Galileo program.[3]

In addition, the United States and Europe had opposing visions for GPS and Galileo. The United States, in addition to the military importance of GPS, sought to promote commercial applications for GPS and to make GPS the global standard for PNT services. The United States envisioned a world with no near-peer global satellite PNT

[3] Beidleman "GPS vs Galileo," 144.

competitor and thus challenged the legitimacy of Galileo.[4] In contrast, some in Europe argued that European reliance on GPS PNT data was untenable and envisioned controlling its own satellite PNT services. These contending visions needed to be adjusted in order to make compromise possible and in order to achieve greater cooperation and interdependence between GPS and Galileo.[5]

In April 2002, in order avoid slips in the Galileo timeline, many interoperability issues regarding GPS-Galileo had to be resolved quickly. The timeline was driven by two considerations. First, there needed to be certainty regarding Galileo's signal structure before issuing contracts for satellite and ground-based equipment and software. Second, the Galileo frequencies which had been negotiated at the ITU WRC in May 2000 would be lost if the first Galileo satellite was not launched and made operational before 14 February 2006.[6] In order to have a Galileo satellite to launch before that date, construction of a Galileo satellite had to begin in 2004 at the latest.[7] Hence, the combination of these factors made negotiations about cooperation and interoperability with the United States time sensitive. The EC's aim in April 2002 was to reach a cooperation agreement with the United States by the end of 2003.[8]

The United States finally recognized the reality that Galileo was likely to get off the ground and offered to resume talks which had broken off in October 2001. In addition, the United States recognized that its Galileo policy and negotiating strategy

[4] David Braunschvig et al, "Space Diplomacy," 161.
[5] Lewis et al, *Building a Multinational Global Navigation Satellite System*, 36.
[6] Warner, "After Much Debate."
[7] Gerry Oberst, "Regulatory Review: Galileo Takes Off-Sending Technology to New Heights," *Via Satellite*, June 1, 2002. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pqdweb? did=121993888&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD. (accessed January 8, 2008).
[8] Commission of the European Communities, *Communication from the Commission to the European Parliament and the Council: State of Progress of the Galileo Programme*, COM (2002) 518 final (Brussels: EC, September 24, 2002), 6.

since 1999[9] (discussed below) had had no impact on what the Europeans wanted to do. It had only delayed the fulfillment of European plans.[10] As a result, with the 26 March Transport Council decision, the United States accepted that Galileo would be built and that an adjustment to American strategy was needed. Nevertheless, the United States was uncertain that a solid enough basis existed to reopen discussions.[11]

The European plan for Galileo produced a number of conflicts with the United States which remained to be resolved. These can be divided into three issue areas: security, trade-related, and technical.[12] First, as previously discussed, the planned Galileo PRS signal would overlay the future GPS military signal and was arguably the main point of contention due to its security implications. Nevertheless, the European position was:[13] 1) that this frequency was the best for Galileo's commercial purposes (For example, it was least susceptible to ionospheric interference and would be the most efficient);[14] 2) The PRS would be encrypted in order to ensure continuity of service for specific government applications (civil, police, defense, and security) even in a crisis when other Galileo services might be denied; 3) The PRS would be designed so as to avoid interfering with the GPS signal; 4) The PRS would have the ability to deny access to specific users; 5) The United States should trust the European Union to adequately protect and manage PRS encryption keys so as to prevent unauthorized access and hostile

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[9] Braibanti, Kim and Wells, "GPS-Galileo Negotiations."
[10] Independent Assessment Team – International Strategic Sub Committee, Interagency GPS Executive Board, "Strategy for International GPS Based Timing and Positioning Service: GPS – Galileo: Opportunity or Peril, Cooperate or Compete," (presentation at IDA, Room 3205, Washington, DC. May 29, 2002), slide 5.
[11] US Department of State, Office of the Spokesman, "Media Note Explains U.S. position on Galileo," March 7, 2002.
[12] Ibid.
[13] This list is derived primarily from: EC Directorate-General Energy and Transport, "Galileo: An Imperative for Europe," *Information Note*, December 31, 2001. 9-10.
[14] Massimo Annati, "Galileo VS. GPS: Battle Over Navigation Warfare?" *NATO's Nations and Partners for Peace* 49 (2004): 88.

use; 6) The ITU at the 2000 WRC had authorized Galileo to use the PRS frequency. Therefore, the United States did not have a right to challenge this decision. In addition, frequencies do not belong to individual states. Even the frequencies used by GPS are not the property of the United States. In sum, the argument went, there were no technical or legal obstacles to Europe overlaying the GPS III military signal.

Of course, as discussed earlier, the overlay of the GPS military signal with the PRS signal would also have ramifications regarding U.S. NAVWAR concepts and provide the EU with political and operational leverage over the United States and GPS respectively. One key EU official acknowledged in the fall of 2002 that the EU wanted to deny the United States the ability to jam GPS unless the EU had input into the decision. "By overlaying the future M-codes of GPS, we ensure that there will be a joint mechanism between the European Union and the U.S. and there will be consideration in using those military/government signals. If we don't overlay, the Americans will be able to do whatever they want without any consultation at all."[15] In addition, the EC admitted in one official document that moving the PRS frequency so as not to overlay the GPS III military signal would give the United States the right to "control PRS users," whereas overlaying the GPS III military signal meant the United States would not be able to jam the PRS signal.[16] The EC desired technical talks to begin as soon as possible in order "to understand [American] concerns," since a political decision could not be made "until

[15] Divis, "GPS, Galileo Draw Closer." Also see Gustav Lindstom and Giovanni Gasparini, *The Galileo Satellite System and its Security Implications*, Occasional Paper 44, (Paris: Institute for Security Studies, April 2003), 23.
[16] Commission, *State of Progress of the Galileo Programme*, COM (2002) 518 final, 33.

technical information has been exchanged and all the possible implications have been reviewed."[17]

In addition to the PRS frequency, the frequencies of Galileo's other signals were also positioned closely to the GPS frequencies. This choice allows dual Galileo-GPS receivers to be built more easily and inexpensively, making it possible for users to utilize GPS-only, Galileo-only, or combined GPS-Galileo signals. In fact, Galileo needed to be compatible and interoperable with GPS in order to maximize its marketability, effectiveness, efficiency, and profitability. European decision-makers realized that so much had already been invested in GPS in Europe militarily, commercially, and in civil infrastructures that the cost of dropping GPS and switching to a pure Galileo system would be prohibitive for potential users. Therefore, interoperability was a necessity from the European point of view.

Trade-related issues were the second major point of contention between the United States and the Europe Union. Since the Galileo project depended on huge amounts of private investment for its Deployment and Operational Phases, Galileo's feasibility depended upon its ability to generate significant revenue. Without a solid plan to generate revenue private enterprise would not contribute to Galileo and the Galileo project, as officially envisioned, would die on the vine. But European plans for generating revenue from Galileo created a number of concerns.

Plans considered for generating revenue from Galileo included requiring the use of Galileo for PNT services in Europe, charging royalties on Galileo chipset sales, and charging commercial subscribers for use of the most accurate, encrypted (but non-PRS) signals. In addition, charging service providers who used Galileo royalties for such use

[17] Ibid., 12.

was considered a legitimate source of revenue based upon Galileo's intellectual property rights and patent protections.[18] Money to fill the public coffers was envisioned as coming from an EU or Member State tax on the sale of all Galileo and GPS terminals in Europe.[19] In addition, the EU could mandate the use of Galileo by Member States. EU officials had stated that eventually PNT users in Europe would be required to use Galileo and Galileo chips. The United States viewed such plans as unfair trade practices which would lock the United States out of the European PNT market, and cause major disruption to NATO military integration and cooperative efforts.[20] The U.S. position was that:

> Europe should not use regulations or system-driven standards to mandate the use of Galileo at the expense of GPS manufacturers, service providers, and users. The U.S. view is that users should be free to choose which system or combination of systems best meets their needs. Similarly, the United States would be against any restrictions on access to information on Galileo that non-European companies may need to participate fully in the equipment and services markets.[21]

The United States strongly opposed Europe's plans for the PRS signal and for generating revenue. Therefore, the United State's negotiating strategy had been that before the United States would engage in technical talks, the EC would have to agree to five principles[22] which the Galileo program would have to abide by: 1) Free access (i.e. open signals, free of charge) to all safety-of-life services and critical infrastructure; 2) Non-interference with current radionavigation [GPS] services, i.e. spectrum protection; 3)

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[18] Beidleman, "GPS vs Galileo," 42.
[19] PricewaterhouseCooper, *Inception Study*, 3.
[20] Beidleman, "GPS vs Galileo," 142.
[21] U.S. Department of State, Office of the Spokesman, "Media Note Explains U.S. Position on GPS-Galileo," March 7, 2002.
[22] Lembke, "EU Critical Infrastructure," 79. Braibanti, Kim and Wells, "GPS-Galileo Negotiations." Independent Assessment Team, "Strategy for International GPS Based Timing and Positioning Service: GPS – Galileo," (presentation at IDA). Each of these three sources lists these five principles differently. The list offered here attempts to consolidate the three lists as precisely and succinctly as possible.

Open market access (non-discrimination) including; equal access to signal specifications, equal access to user markets (free trade), market driven competition, free choice for end users 4) Some sort of interoperability with GPS and the protection of national security interests; 5) Use of common time and geodesy reference system with GPS.

Brief consideration of these "principles" shows why talks had gone nowhere in the preceding years. The first principle took away much profit making potential of one of Galileo's primary sources of potential revenue. The second principle meant that the EC would agree not to overlay GPS signals, even though the ITU may have already recognized the EU's right to do so. The third principle would waive any intellectual property right protections to Galileo's technical specifications, and surrender EU regulatory powers for mandating Galileo's use in Europe. The fifth principle meant that GPS would be locked in as the global standard for GNSS and the United States would maintain global leadership in PNT services.

If the EU had agreed to these principles before negotiations had even begun the EU would have had little with which to negotiate. Moreover, agreeing to these conditions would have significantly undermined Galileo's revenue generating potential, which, given the importance of making Galileo a PPP, would have potentially killed the project.

Therefore, it is not surprising that talks between the United States and the EU from 1999 until early 2002 had not been productive. On another note, the United States had engaged in extensive bilateral and multilateral "outreach" efforts with European Union Member States in order to try to shape the course of Galileo's development. However, the EU Member States were able to maintain a united front and the United

States did not succeed in this apparent effort to fragment the EU's position.[23] The United States and the EU were resolved to maintain their positions on the PRS/GPS overlay issue and trade issues.

So these were the main positions of the United States and the European Union just after the 26 March 2002 Transport Council decision. Although the United States and EU stated the desire for an agreement, U.S. - EU talks did not resume until 21 June 2002 and quickly went nowhere again. Neither side would budge. The United States refused to compromise on the PRS overlay issue and refused to engage in technical talks about interoperability until it was resolved. Talks in October 2002 also failed to make progress.

NATO officially stayed neutral in the negotiations. However, at the end of 2002 every NATO member state except France officially agreed to a NATO policy position which declared the importance of the GPS military code to NATO operations. It was agreed that NATO should be able to deny access to any other satellite navigation system during a conflict. It was also noted that Galileo's PRS caused NATO to worry.[24] This may indicate the possibility that realist factors were vectored to the EU via the NATO military alliance and weighed on European decision-makers' minds in the ultimate agreement to move PRS away from the GPS III military signal.[25]

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[23] Braibanti, Kim and Wells, "GPS-Galileo Negotiations," slide 7.

[24] Peter B. de Selding, "U.S., European Negotiators Hopeful About Galileo Deal," *Space News* (June 2, 2003). http://www.space.com/spacenews/archive03/dealarch_061203.html (accessed January 9, 2008).

[25] I was not able to find evidence that this NATO policy position influenced the ultimate decision to cooperate. However, based upon the fact that European defense officials helped pressure the EU Transport Council to approve the Development Phase in early 2002, it is fair to speculate that this NATO position may have been an important influence on breaking the stalemate in the Galileo-GPS negotiations. As noted in the narrative above, in April 2003, a few months after this NATO position was released, anonymous European officials stated that the EU was willing to move the PRS signal frequency. However, I was not able to find evidence of a casual connection. Likewise, I came across subtle hints that the Galileo-GPS negotiations were influenced by the debate over the evolving relationship between NATO and the ESDP's growing capabilities and ambitions.

In early April 2003 anonymous European government sources were reported to have said that Europe might be willing to move the PRS signal "slightly" but only if an overall agreement on GPS and Galileo was reached.[26] Also in April 2003, one European government official had said:

> We now accept that, yes, the U.S. will be able to jam our [Public Regulated Service] signal without jamming the GPS signal. We no longer are adopting the view that it is strategically important to have mutually assured jamming capabilities. But let's be clear: Our agreement on this is subject to a global political agreement with the U.S. on how Galileo and GPS will cooperate.[27]

Nevertheless, on 26 May 2003 Ralph Braibanti, the U.S. State Department head of the U.S. negotiating team stated, "We have talked ourselves to death on both sides, hoping the [PRS overlay] issue would work itself out."[28] However he expressed hope that an agreement could be made by the fall of 2003.

Another issue regarding PRS was percolating at the same time as the PRS/GPS overlay issue. Galileo's PRS created a debate within Europe over its necessity. The French pushed for PRS for reasons of strategic independence and arms sales, but not all

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[26] De Selding, "U.S., European Negotiators Hopeful." Also Peter B. de Selding, "Europe Takes Steps To Prevent Galileo From Interfering with GPS Military Code," *Space News* (April 15, 2003). http://www.space.com/spacenews/archive03/galileoarch_041503.html (accessed January 9, 2008).
The behind the scene story of the GPS –Galileo negotiation is yet to be told. In researching this paper, I was in contact with high level members of the U.S. negotiating team. I specifically asked about the trade-offs made in order to reach the Galileo-GPS agreement but due to the sensitivity of these questions, I was unable to get any answers. (See footnote 539 for a list of the questions). I also asked the contacts if they could point me to any good "open sources" from which I might get a clearer picture of the bargaining that went on. They also declined to do that for me. Therefore, this paper relies heavily in this section upon reports from well-regarded periodicals and journalists that specialize in reporting on the space sector and on GPS/Galileo issues.

[27] Peter B. de Selding, "Europe Takes Steps To Prevent Galileo From Interfering with GPS Military Code," *Space News* (April 15, 2003). http://www.space.com/spacenews/archive03/galileoarch_041503.html (accessed January 9, 2008). Also Beidleman, "GPS vs Galileo."

[28] De Selding, "U.S., European Negotiators Hopeful."

EU members agreed on the need for it.[29] The French always intended to arm their future forces with PRS along with the use of the GPS military code (via NATO access).[30] But by late 2002, there was significant disagreement among EU members about the need for PRS and discontent with France was rising within the EU over the issue.[31] The United Kingdom continued to insist that Galileo should be strictly for civilian use and said its military forces would not use PRS. The United Kingdom also sought to deny other European countries the military use of PRS.[32] Germany refused to say if it would use PRS in its defense forces. Since PRS raised Galileo costs, Germany was not satisfied that it was a cost effective capability. There were also hints that Britain objected to the additional cost that PRS put on Galileo. (In addition, there were suspicions that Britain was defending the GPS military signal for the United States).[33] The fact that PRS remained a part of the Galileo program despite its negative affect on cost effectiveness may indicate that realist factors were more significant than liberal factors at this point.

The main sticking point in the EU – U.S. negotiations remained the PRS overlay issue. Major breakthroughs finally came at two partially classified meetings.[34] The first was held in London on 4-5 September 2003, and the second at The Hague on 19

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[29] Divis, "GPS, Galileo Draw Closer."
[30] De Selding, "Britain, France at Odds."
[31] Divis, "GPS, Galileo Draw Closer."
[32] De Selding, "Britain, France at Odds."
[33] Ibid.
[34] Again, it was not possible to determine what precisely led to the breakthrough. My well placed sources on the U.S. negotiating team declined to answer the following questions due to what they described as the "extreme sensitivity" and "political sensitivity" of these questions: What was the most significant cause of the EU finally agreeing to move the PRS signal so it would no longer overlay the M-code? External pressure from the United States? Or did the United States make a major concession? Or did internal pressure come from within Europe to make an agreement? Or were there purely technical reasons that made it a non-issue? Who was driving the boat for the EC? Specifically, did any European military/defense official's influence the negotiations (Other than just technical consulting)? Were any such defense authorities driving the negotiations or the EC position behind the scene? Or were negotiations mainly driven on the European side by people with a more civil/economic/technical focus? What county's negotiators carried the most weight, France, the UK, Germany? Did any military or defense officials in Europe have the right to "veto" the agreement before it was signed?

November 2003.[35] On the basis of the discussions at those meetings, an agreement on Spectral Separation Coefficients (SSC) was reached that made GPS and PRS signals compatible and removed the security risk to the United States. The bottom line is that the EU agreed to modify its position.[36] This effectively meant that the United States would be able to jam Galileo's PRS signal in an area of conflict and the United States (and NATO) would still have unimpeded use of the GPS military signal without having to consult with the EU first. The EU gave up its leverage over GPS NAVWAR operations and sacrificed a measure of strategic independence. However, there were still other issues to be discussed.

In January 2004 the EU also agreed to move its Open Service signal, which also had the potential to interfere with the GPS III military signal.[37] In return, and very significantly, the United States agreed to transmit its future GPS III open signal on the same frequency as the Galileo Open Service signal. This Galileo-GPS common open signal ensured maximum interoperability for the benefit of all users.[38] (It would also make simultaneous jamming of the two open signals easier).[39]

Also in return, the United States offered to share advanced navigation satellite technology such as information on atomic clocks, radiation shielding, and ground control systems. The United States also dropped its demand that it must have veto power over

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[35] Commission of the European Communities, *Communication from the Commission to the European Parliament and the Council: Progress Report on the Galileo Research Programme as at the Beginning of 2004*, COM (2004) 112 final (Brussels: EC, February 18, 2004), 12.
[36] Peter B. de Selding, "Europe Concedes to U.S. on One GPS, Galileo Roadblock," *Space News*, (January 6, 2004): 9.
[37] Beidleman, "GPS vs Galileo," 145.
[38] Ralph Braibanti, (opening remarks at a Joint Press Event, European Commission, Breydel Building, Brussels, February 26, 2004.
[39] My observation.

future changes to Galileo's signal structure.[40] The United States and the EU also agreed to a joint national-security document that limited unilateral action by either party.[41]

In addition the EU agreed to non-discrimination and open markets in terms of the trade of satellite navigation-related goods and services, and agreed to provide open access to information concerning signal specifications, signal structures, and frequency characteristics. In other words, American companies would have full access to Galileo technical information and markets in order to compete in the market for Galileo applications and services. The United States also recognized that World Trade Organization (WTO) rules applied to commercial GPS activities.

On 1 March 2004 NATO released a brief statement that stated that NATO welcomed the agreement and stated that, "Vital NATO military capabilities are protected under this arrangement."[42]

After two years of hard negotiations an agreement was reached. On 26 June 2004, the EU and the United States signed an official agreement called the "Agreement on the Promotion, Provision and Use of Galileo and GPS Satellite-Based Navigation Systems and Related Applications."[43] U.S. Secretary of State Colin Powell, who signed the agreement for the United States, hailed the agreement as a remarkable achievement and said that "[the agreement] manages to balance the competition that is inherent in the commercial dimension of satellite navigation technology with the cooperation necessary

[40] Commission, *Progress Report*, COM (2004) 112 final, 12.
[41] Peter B. de Selding, "Frequency Concession Removes Galileo Agreement Roadblock," *Space News*, (February 9, 2004). http://www.space.com/spacenews/archive04/galileoarch_020904.html (accessed January 9, 2008).
[42] NATO, "NATO Statement on the EU Commission – US Agreement on GPS/Galileo cooperation," Press Release (Brussels: NATO, March 1, 2004). http://www.nato.int/docu/pr/2004/p04-026e.htm (accessed March 20, 2008).
[43] The White House Office of the Press Secretary, "U.S.-EU Summit: Agreement on GPS-Galileo Cooperation," Fact Sheet, June 26, 2004.

for the security dimension."[44] He also noted that the agreement guaranteed a mutually beneficial relationship between GPS and Galileo and enhanced their common benefits.

Four U.S. – EU working groups were established in order to ensure the systems remained interoperable going forward: a working group on interoperability issues; a working group on future system designs; a working group on trade and non-discrimination issues; and a working group on security issues which would also discuss civil and military signal interfaces.[45]

In sum, European decision-makers decided to abandon overlaying PRS on the GPS III military signal. In effect, they agreed to give up their leverage over the United States and agreed to allow the United States the unilateral power to jam Galileo's PRS signal. However, in return they agreed to provide Galileo and GPS with common open signals, significantly improving their interoperability, compatibility, and overall quality. They also agreed to make Galileo more open in international trade terms.

We are left with indicators that a complex mixture of realist, liberal, and ideational factors influenced European decision-makers' assessments of the need for the Galileo – GPS agreement. Which factor influenced these decisions the most?

2. Findings:

This chapter traced events directly connected to the June 2004 EU - U.S. agreement on Galileo - GPS compatibility and interoperability. Since this chapter keeps a very narrow focus relative to the other chapters, it requires that we slightly amend this study's

[44] Colin Powell, U.S. Secretary of State, "Remarks at the Signing of the Galileo Treaty," (remarks made at Dromoland Castle, Shannon, Ireland, June 26, 2004).
[45] Heinz Hilbrecht, (opening remarks at a Joint Press Event, European Commission, Breydel Building, Brussels, February 26, 2004).

hypotheses. This does not affect the paper's methodology or findings, however. The hypotheses are amended to read: "[realist, liberal, ideational] factors weighed the most on European decision-makers' assessments of the need for the Galileo – GPS agreement.[46]

There is considerable evidence that liberal factors weighed the most heavily in the decision making process leading to the Galileo - GPS agreement. There is little concrete evidence that realist factors played the most significant role. However, this study uncovered subtle hints that significant realist factors might be lurking beneath the publicly available information. And once again, there is a lack of evidence to support the hypothesis that ideational factors were the most significant.

Hypothesis A2: Realist factors weighed the most heavily on European decision-makers' assessments of the need for the Galileo – GPS agreement.

I reject Hypothesis A due to indicators that realist factors did not weigh the most heavily on European decision-makers' assessments of the need for the Galileo – GPS agreement in 2004.

First, negotiations for the EU team were headed by Heinz Hilbrecht, the head for land transportation in DG TREN. In addition, the agreement had to be approved by the EC Transport Council[47] and the June 2004 agreement was signed by EC Vice President and Transportation Director General Loyola de Palacio.[48] The civil and economic focus

[46] The amended Hypotheses are annotated as *Hypothesis A2, Hypothesis B2, and Hypothesis C2.*
[47] De Selding, "Frequency Concession."
[48] The GPS – Galileo agreement was a "mixed" agreement between the United States and the EC, but also between the United States and each Member State of the EU. This was the first time such a "mixed" agreement was signed by the United States, and the United States had questions prior to the signing about what took precedent, the multiple bilateral agreements or the agreement signed with the EC.

of DG TREN and the EC Transport Council make it doubtful that the EC negotiators were motivated by military power considerations or the desire to balance American power. Unlike the decision to enter the Galileo Development Phase in March 2002, there is no concrete evidence that military or defense authorities pressured the EC negotiators to reach an agreement with the United States.[49] There is also little evidence that Prime Ministers or Heads of States tried to influence the agreement for national power reasons.

There are conflicting indicators, however, about how the agreement affected EU (ESDP), NATO, and Member State military capabilities.

First, the agreement does not benefit the EU's independent military capabilities. Moving the PRS signal so that it did not overlay the future GPS III military signal removed the EU's potential ability to influence the U.S. NAVWAR plans. After the agreement, the United States could plan to jam the PRS signal without the fear of jamming the GPS military code simultaneously. The EU lost a major source of political and military leverage over GPS with this agreement and created a vulnerability for Galileo and its users, including future European military users.[50]

On the other hand, European militaries, individually and as members of NATO, had already invested significant sums of money into GPS applications. Recall that there is significant overlap in NATO and EU membership. Compatibility and interoperability between Galileo and GPS would ensure that individual European states did not lose the costs already sunk into GPS equipment, and would make their PNT-using military systems more efficient and precise. Likewise, interoperability would bolster Europe's position in the European and international arms markets. Additionally, the broader

[50] It is reasonable to argue, however, that realist factors weighed heavily prior to the EU agreeing to move the PRS signal. This study was not able to determine precisely what caused this change in position in late 2003.

interoperability of NATO forces would be enhanced by making Galileo and GPS as compatible and interoperable as possible. Finally, while the mutual benefits of placing GPS and Galileo open signals on a common frequency have been trumpeted loudly, little has been said about the fact that it also makes simultaneous jamming of the open signals easier. In sum, NATO and individual European states gained from the agreement militarily.

Moreover, although NATO was officially neutral on the negotiations, the 2002 NATO GPS policy position showed that European defense ministers had an opinion on the matter and logically intimates that they may have worked behind the scenes to influence the transport ministers to move the PRS signal. In addition, the U.S. negotiators descriptions of my questions on the topic as “extremely” sensitive and “politically” sensitive and their unwillingness to answer them or direct me to helpful unclassified sources also hints that there was more military or security influence in the negotiations then publicly acknowledged. Nevertheless, due to a lack of evidence, this paper must not give too much significance to the conjecture in this paragraph and must base its finding on more solid evidence.

As for “power balancing” considerations, the agreement does not appear to balance American military, economic, or diplomatic power. It is also unlikely that the agreement was motivated by a desire to balance other powers. Although the EU, through the ESDP, was building its military capabilities during this period, and getting involved in military missions, such as the EU military deployments to the Balkans and Africa, these demonstrations of a more realist orientation among European Union decision-makers do not appear directly relevant to the Galileo – GPS agreement. In fact, the EU

was trying to find as many international partners in the Galileo project as possible, much to the dismay of ESA and the European space industry. These efforts were motivated by DG TREN's imperative to spread the costs of Galileo as Europe's contribution to the GNSS as widely as possible - not to create political and military alliances for balancing purposes.

In addition, it does not appear that the pursuit of zero-sum economic gains motivated European decision-makers to reach this agreement. The evidence suggests that they agreed to make the Galileo Open Service frequency the same as the GPS open signal frequency primarily in order to make the combined GPS-Galileo system more precise and more attractive to customers – not to make it easier to jam. Likewise, the "non-discrimination" clause and the clause to make Galileo signal specifications publicly available are counter to zero sum economic motives.

Therefore, this study found that while many realist factors were involved, they were most likely intervening variables in the decision to make the GPS –Galileo agreement.

Hypothesis B2: Liberal factors weighed the most heavily on European decision-makers' assessments of the need for the Galileo – GPS agreement.

I do **not** reject Hypothesis B due to several indicators that liberal factors weighed the most heavily on European decision-makers' assessments of the need for the Galileo – GPS agreement in 2004. In short, the agreement creates interdependence, a significantly better capability, and mutual economic benefits.

Europe had shown the desire for cooperation with the United States in the development and operation of a civil navigation satellite system since the 1960s. The 2004 GPS-Galileo interoperability agreement was the fruition of many years of "off-again/on-again" European efforts to achieve this goal. The European desire since the 1960s had consistently been to create a civil navigation satellite system in order to provide navigation services as a mutually beneficial service. Also, in the 1990s the EU began to develop the EGNOS system, based upon the use of GPS signal, in order to improve its transportation infrastructure.

In addition to the major indicators mentioned in the section above regarding the efficiencies and mutual gains achieved by the agreement, it is also reasonable to argue that civil and commercial actors supplied significant pressure on the negotiators to achieve an agreement. First, the European space industry needed the Galileo contracts as soon as possible in order to survive a severe downturn in the government and commercial space sectors. Second, the potential loss of the space industry would severely hamper the EU's Lisbon Goals of making the EU "the most competitive and dynamic knowledge-based economy of the world."[51] The loss of such a high technology industry, with the corresponding loss of expertise, would be a severe setback for the European Union.

The leadership and funding roles of ESA and DG TREN and the requirement for Galileo to be a PPP also kept the priority on economic gains rather than on realist power considerations.

[51] European Union, Activities of the European Union, Summaries of Legislation, "Challenges for the European Information Society Beyond 2005," http://europa.eu/scadplus/leg/en/lvb/124262.htm (accessed August 3, 2007).

Hypothesis C2: Ideational factors weighed the most heavily on European decision-makers' assessments of the need for the Galileo – GPS agreement.

I reject Hypothesis C2 due to a lack of evidence that ideational factors weighed the most heavily on European decision-makers' assessments of the need for the Galileo – GPS agreement in 2004.

First, if a sense of shared identity with the United States influenced the European decision-makers, then why wasn't the decision reached earlier? Did something occur during the negotiations which increased the sense of shared identity? The war in Iraq ran throughout this period. European opinion was against the war, however, and the war did more to divide Europe from the United States than unite them. In addition, the terrorist attacks in Madrid in March 1994 occurred after all the major compromises in the GPS-Galileo negotiation had been agreed upon. So any increased sense of shared identity between the United States and Europe in the fight against Muslim extremist terrorism most likely had little to do with the GPS-Galileo agreement.

However, the long history of cooperation between Europe and the United States may have influenced positively the desire for an agreement - despite any hard feelings caused by the Wolfowitz letter. In addition, the level of trust between negotiating sides based upon this long history may have made the sides willing to bargain in good faith until a mutually beneficial agreement could be reached. This is not an unreasonable idea. However, this study found no evidence to support it. It is likely that ideational factors were an intervening variable in the decision to make the GPS –Galileo agreement.

Conclusion

It is important to point out that the European decision to not overlay the GPS III military signal with the Galileo PRS signal was the major breakthrough in U.S.-EU negotiations. A more detailed investigation of what caused the EU and the United States to change their positions would help complete the picture of what happened in the run up to the June 2004 agreement.

Nevertheless, the evidence shows that it is reasonable to assert that liberal factors at the international level were the most important motivators for European decision-makers to reach an agreement with the United States making Galileo and GPS compatible and interoperable.

Chapter Seven:
Altering Course

Chapter Seven traces the complex events from the start of the Development Phase in March 2002 to the November 2007 EU decision to drop Galileo's PPP funding and management structure and to fund the Deployment Phase completely with money from the EU budget. Leaving aside the negotiations between the European Union and the United States over Galileo and GPS compatibility and interoperability that were discussed in Chapter Six, this chapter investigates the broader context surrounding Galileo throughout the Development Phase. Figure 8 outlines many of the key events during the five year period covered in this chapter.

March 2002	Transport Council approval of Galileo Development Phase.
2002	Slump in European space sector.
	German, Italian competition for Galileo program leadership.
May 2003	German, Italian leadership competition issue resolved.
June 2003	Galileo Joint Undertaking (GJU) established. Contracts for Giove-A and Giove-B Galileo test satellites approved.
October 2003	China-EU Galileo cooperation agreement.
December 2003	ESA interpretation of "peaceful purposes" relaxed.
June 2004	Galileo – GPS agreement signed.
September 2004	EURELY and iNAVSAT consortia submit concessionaire bids.
June 2005	EURELY and iNAVSAT make combined concessionaire bid.
Summer 2005	At ESA, Germany uses Galileo cost overruns to get more returns.
	Delays final contract for four IOV satellites and ground network.
December 2005:	Successful launch of Giove-A; the first Galileo satellite launched
	Agreement brokered at ESA. Germany satisfied with returns.
February 2006:	EC security space capabilities tested - ASTRO+.

Remainder 2006:	EC - Merged Consortium negotiations deadlock over allocation of program risk.
Mid-2006	China reveals plans for Beidou/Compass navigations satellites.
January 2007	GJU closed. GSA begins operation. China ASAT test.
April 2007	European Space Policy released.
June 2007	Transport Council agrees on concept of full public funding for Galileo's deployment.
November 2007	Full public funding for Galileo's deployment approved.

Figure 8: Galileo Program Key Events: 2002 - 2007

This study found that by 2007 a confluence of realist, liberal, and ideational factors was able to overcome especially stiff challenges to Galileo's survival from the national and industrial levels, even as the business case for Galileo steadily eroded. However, indicators that realist factors weighed on European decision-makers' assessments of the need for Galileo became more prevalent at the end of the Development Phase. For example, during the Development Phase open acknowledgment and acceptance of Galileo's "security" aspects slid steadily from left to right along the security continuum introduced in Chapter Two (Human security – Environmental security - Economic security – Military security). By 2007 Galileo's latent military uses were openly acknowledged and were even welcomed as a potential source of future revenue. For these reasons and others this study does **not** reject ***Hypothesis A***: ***Realist factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.***

1. Developing Galileo:

March 2002 – December 2002: Stalled again at ESA

In its 26 March 2002 decision to approve Galileo's Development Phase, in addition to directing that Galileo be interoperable with GPS, the Transport Council gave direction to the EC on the organization of the Galileo project and its finances.

First, the Transport Council agreed to the establishment of the Galileo Joint Undertaking (GJU) as the single management structure for Galileo's Development Phase. The EC was directed to establish the GJU in cooperation with ESA and "without delay."[1] In response, on May 21, 2002 the GJU was formally chartered.[2] The GJU was strictly a civil organization with no military or defense involvement. Its purpose was to manage the Galileo's Development Phase and select a concessionaire to manage the Deployment and Operational Phases. Its first task was to issue the initial contracts for Galileo. Subsequently, private companies as well as international partners would be encouraged to become members of the GJU. The European Investment Bank was also invited to be a member.

In addition, the Transport Council called for a military organization to be formed by the end of 2002. This "Security Board," as it was called, was to advise on the Development Phase. The Security Board was to be composed of representatives of Member States. Its purpose was twofold. The Board was to guide the security arrangements needed to keep the Galileo system and infrastructure secure. This included responsibility for monitoring and controlling access to the encrypted PRS signal and

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[1] "2420th Council Meeting," 21.
[2] Commission, *State of Progress of the Galileo Programme*, COM (2002) 518 final, 2.

ensuring signal denial to hostile nations where necessary.[3] In addition, the Security Board would provide an official organizational interface with Member State military and defense authorities. This indicates again that realist factors were present at the time of the decision to enter the Development Phase. However, the Security Board was not officially in place by the end of 2002.

At this time it is also important to note, however, that within the second pillar of the EU, neither Javier Solana's policy organization nor military staff included a space unit. Pillar Two also did not control a budget for the development of space capabilities. In addition, the working relationship between the EC and Solana's staff on space issues was not effective.[4] Moreover, there was no high-level space advocate for either civilian or security space activities within the EU. The fragmented nature of the EU space initiatives, as described in Chapter Two, make it difficult to argue that the EU second pillar was somehow pulling the strings on Galileo behind the scenes.

The Transport Council's March 26 decision did not change the sources of funding discussed previously. None of Galileo's funding came directly from defense budgets.[5] The EC's TEN budget, ESA, and the private sector were to fund the development phase through the GJU. In addition, the Transport Council stated that Member States would not be requested to make direct financial contributions to the Galileo program. National budget contributions would come only through ESA during the Development Phase.[6] It also stated that any further public sector funding, in any of its phases, would be met

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[3] Taverna, "Europe Declares Satnav Independence." In addition, one source says that one of the Security Board's purposes is to guide the military applications of Galileo. Divis, "Military Role for Galileo Emerges." However, this source is the only source found that makes this claim.
[4] Logsdon, "A Security Space Capability for Europe?" 278.
[5] Lindstom and Gasparini, "The Galileo Satellite System and its Security Implications," 15.
[6] EC Directorate-General Energy and Transport, "Galileo: An Imperative for Europe" *Information Note*, December 31, 2001, 4.

through the redistribution of funds under the EU Financial Perspectives in force at the time. There is no evidence that defense or military funds were involved in Galileo's Development Phase either directly or indirectly.

The Transport Council's 26 March 2002 statement also noted that public sector funding of subsequent phases should be kept to a minimum and that the EC should negotiate with the private sector to secure a cost-share for the Deployment Phase of at *most* 1/3 for the EC and at *least* 2/3 for the private sector. However, Galileo's weak business case made the private sector very reluctant to commit to funding Galileo on such a large scale.[7] The Director of Galileo Industries at the time, Mike Healey (reaffirming a view also reported in November 2001)[8] said, "The cost and financing is contentious. There is a compelling case for full public-sector funding." He added "A number of the Galileo players would prefer to move into a fully [public] funded activity."[9]

Somewhat surprisingly, given the importance attached to making Galileo a PPP, an EU official also assured that "the government" would consider funding Galileo's Deployment Phase if private sector support failed to materialize.[10] In late 2002 some EC officials reportedly made similar statements stating that getting the private sector to

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[7] Alain Chappe, CNES Head of Brussels office, interviewed by author Brussels, BE, December 5, 2007. He said that many observers always thought private sector funding of the Deployment Phase was a big problem.

[8] "December is Make or Break Month for Galileo," *Global Positioning and Navigation News*, November 14, 2001. http://proquest.umi.com.proxygw.wrlc.org/pqdweb?index=17&did=89860629&SrchMode=1&sid=2&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1223434092&clientId=31812 (accessed January 8, 2008)

[9] Douglas Barrie and Michael A. Taverna, "Galileo Orbit Hangs on Funding Strings," *Aviation Week & Space Technology* 156, no. 13 (April 2002): 25. http://dz6nh2ph2d.search.serialssolutions.com/directLink?&atitle=Galileo's%20Orbit%20Hangs%20On%20Funding%20Strings&author=Douglas%20Barrie%3B%20Michael%20a.%20Taverna&issn=00052175&title=Aviation%20Week%20%26%20Space%20Technology&volume=156&issue=13&date=20020401&spage=25&id=doi:&sid=ProQ_ss&genre=article&lang=en (accessed January 15, 2008).

[10] Dee Ann Divis, "Military Role for Galileo Emerges," *GPS World* (May 2002): 10. Divis does not identify the EU official who made this statement except to imply that it was an official deeply involved in the Galileo program.

contribute significantly to the Development Phase and Deployment Phase was unlikely and that the EU and ESA would eventually agree to use public funds to fully finance Galileo's development and deployment.[11] This behind the scenes outlook may have undermined the official position of the Transport Council. Nevertheless, the possibility of full public funding also hints at the growing strategic importance of Galileo to Europe versus its potential commercial profitability.

In fact, the European space sector faced a deteriorating situation in 2002. As mentioned previously, a deep slump in Europe's space sector began to severely threaten the European aerospace industry soon after the turn of the century. Eurospace reported that European space sector consolidated revenues between 2000 and 2001 dropped 6 percent. Between 2001 and 2002 revenues dropped another 11.3 percent.[12] Crises in the launch and satellite manufacturing markets illustrate the problem.

First, external market changes and the emergence of new commercial competitors created a crisis in the commercial space launch sector. Chief among the commercial competition was International Launch Services (ILS), which provided cheap and reliable launch services.[13] This threatened the commercial survivability of the European launch industry, i.e. Arianespace, which neared bankruptcy in early 2003. The threat to Arianespace shook the European space sector and forced policy-makers to realize that more than Arianespace was threatened. In fact, Arianespace represented Europe's sole capability for independent access to space. It was a wake up call to Europe that if it

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[11] Dee Ann Divis, "GPS, Galileo Draw Closer," *GPS World* (November 1, 2002). http://www.gpsworld.com/gpsworld/Expert+Advice+&+Leadership+Talks+(System+Design+&+Test)/GPS-Galileo-Draw-Closer/ArticleStandard/Article/detail/39281. (accessed December 20, 2007). Divis did not identify the officials making these statements.
[12] Shirvanian, ed. *2004 European Space Directory*,10.
[13] Gilles Maquet, formerly Vice President, Institutional Relations, EADS Space, interviewed by author, Paris, France, June 10 2004.

didn't immediately develop the will to save Arianespace, it would be too late. In response, European decision-makers relatively quickly agreed to financially support Arianespace through the European Guaranteed Access to Space (EGAS) program which was adopted in May 2003.[14] EGAS was an indicator that the will existed in Europe to safeguard this crucial European strategic space capability.[15] Top European political leaders accepted the notion that Europe's independent access to space was a crucial European strategic asset.

Second, the severe crisis in the broader European commercial space sector included satellite manufacturing. Rosy projections in the 1990s for huge growth in demand for commercial space failed to materialize. As a result, Europe's space infrastructure weakened severely. The lack of commercial and public sector demand made the European space sector difficult to sustain. The joint European Commission and ESA *Green Paper on European Space Policy* in early 2003 noted, "there is a real danger that the very high level of skill and technologies that Europe has acquired cannot be maintained."[16] Remember from Chapter Two that ESA "Basic" activities included the maintenance of industrial and technological capabilities required for the existence of Europe's independent space programs. The threat to these capabilities added to the Europeans' sense that their independent space capabilities were vulnerable. Later, the

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[14] European Commission, *White Paper: Space: a New European Frontier for an Expanding Union, An Action Plan for Implementing the European Space Policy, EC White Paper*, (Luxembourg: European Commission, 2003), 26.

[15] Ariane rockets also represent a significant strategic military capability although this fact is not often acknowledged.

[16] Bruce Battrick, ed., *Green Paper Report on European Space Policy: Report on the Consultation Process*, (AG Noordwijk, The Netherlands: ESA Publications Division, 2003), 16.

2003 *White Paper* identified two dangers: the decline of leading space companies and the decline of space power capabilities.[17]

Meanwhile, in May 2002 Germany, Italy, the United Kingdom, and France each wanted to fund 25 percent of ESA's 550 million euro contribution to the Galileo program. However, smaller ESA Members States, led by Spain, also wanted to contribute to the Galileo project for a cumulative total of another 33 percent.[18] Galileo was "oversubscribed."

For political and economic reasons Italy and Germany each wanted to contribute the most in order to claim the leadership role in the Galileo program.[19] Italy based its claim to the leadership role by pointing out that it had been an early supporter of Galileo and it had never received a leading role in past prestigious ESA programs.[20] Germany based its claim on the fact that Germany contributed the most to ESA. Germany even upped its proposed contribution to 30 percent.

ESA was also involved in other aspects that affected the environment surrounding the Galileo program during this period. First, the relationship between the EC and ESA continued to coalesce. Second, European Union interest in military security activities and the contribution that space capabilities could contribute to those activities continued to increase. However, the growing interest in Galileo's military security aspects was a sensitive topic for the neutral ESA Member States such as Sweden, Austria, and

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[17] European Commission, *White Paper*, 10.
[18] "Galileo Progress Labours Through ESA Dispute," *GPS World* (October 24, 2002). http://www.gpsworld.com/gpsworld/content/printContentPopup.jsp?id=118802 (accessed January 22, 2008).
[19] GPS World "Galileo Progress Labours through ESA Dispute." *GPS World* cites a well-placed EU official for this information.
[20] Lindstom and Gasparini, "The Galileo Satellite System and its Security Implications," 17.

Ireland,[21] despite the assurances made in the November 2001 "Wise Men's Report" that it was legitimate for ESA to participate in EC security-related activities. But ESA overcame those hesitations rather rapidly.

At the November 2001 Edinburgh ESA Ministerial Council meeting, EC President Romano Prodi had invited ESA and the EU to pay more attention to security and defense, to which ESA Director General Rodota responded favorably and stated that he would examine how space technologies could be used in the Common Foreign and Security Policy (CSFP). He stated that ESA should contribute to European security, "though this will not consist in starting up military programs, let there be no mistake about that." In June 2002, however, ESA Director of Strategy and External Relations Jean-Pol Poncelet acknowledged that based upon a rereading of Article II of ESA's convention, "for exclusively peaceful purposes" essentially meant for "non-aggressive" purposes.[22] This interpretation opened the door for ESA's participation in security-related programs. In addition, he noted that ESA participation in security and defense programs was a way for ESA to broaden the financial base of its space activities.

Meanwhile, on 17 June 2002, EC Vice President and Transport Director-General de Palacio announced the establishment in China of a Sino-European "center for cooperation on satellite radionavigation."[23] This became the "China-Europe GNSS Training and Technical Cooperation Center" and became operational on 19 September 2002.[24] Its purpose was to promote joint activities involving training, experiments,

[21] Thanks to Dr. John Logsdon for emphasizing the role of the neutral countries.
[22] ESA, "The European Union and ESA: the Need for Closer Working Relations," June 20, 2002. www.esa.int./esaCP/ESA6WZNED2D_index_o.html (accessed January 7, 2008).
[23] Commission, *State of Progress of the Galileo Programme*, COM (2002) 518 final, 9.
[24] Commission, *Progress Report*, COM (2004) 112 final, 9.

applications, industrial cooperation and testing pilot applications in the priority areas of rail, inland waterways, and maritime transport.[25]

In July 2002, the EC released the report *Strategic Aerospace Review for the 21st Century (STAR 21)* which recommended a fully European satellite-based defense and security capability for surveillance, reconnaissance, telecommunications, and positioning.[26] This shows that the momentum for more European militarily useful space capabilities continued to increase.

At the national level, on 30 July 2002 Germany and France signed an agreement for the German military radar "SAR-Lupe" satellite and the French military "Helios" reconnaissance satellites to share information. These military owned and operated satellite systems were designed to support strategic level decision-making by top officials rather than tactical level military use. Nevertheless, this agreement illustrates that cooperation among Europe states in security space activities continued to grow and strengthen.

Interestingly, a poll was conducted in June and July 2002 by the German Marshall Fund and the Chicago Council for Foreign Relations. People in the United Kingdom, France, Germany, Italy, The Netherlands, and Portugal were surveyed. Overall, 65 percent of respondents thought the EU should become a superpower like the United States with 91 percent of respondents in France expressing this sentiment.[27] Realist sentiments appeared to be growing among European citizens.

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[25] Ibid., 10.
[26] Commission of the European Communities, *STAR21: Strategic Aerospace Review for the 21st Century; Creating a Coherent Market and Policy Framework for a Vital European Industry*, (Brussels: EC, July 2002), 37.
[27] Hill, "The Common Foreign and Security Policy of the European Union," 8. I was not able to check the methodology of this survey in order to confirm its scientific validity.

Nevertheless, the dispute between Germany and Italy over Galileo's leadership delayed the setting up of the GJU which had been chartered in May 2002. By September 2002, the EC stated that if no solution was found in the short term, "the matter will have to be referred to the European Union."[28] The EC also stressed that the GJU had to be set up as quickly as possible in order for call for tenders for the Development Phase to be approved. The ESA financial shares controversy was delaying progress in setting up program staff, organizing the GJU, letting out contracts for building the first Galileo satellites, building the ground infrastructure, and granting the concession contract to operate the system once it was built.[29]

A compromise was almost reached in early December 2002 in which Germany and Italy each would contribute 17.5 percent and agree to share the leadership role. However, old habits die hard. A dispute now arose between Spain and Germany which contributed to the collapse of the compromise. Spain wanted to increase its role in the Galileo project and wanted to raise its industrial share.[30] Then the compromise between Germany and Italy fell apart on 20 December 2002 when Germany backed out of the agreement after Italian officials said that despite the financial agreements, Italy would be the program's leader.[31] ESA's Director General Rodota commented, "This is a hard blow

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[28] Commission, *State of Progress of the Galileo Programme*, COM (2002) 518 final, 3.
[29] GPS World, "Galileo Progress Labours through ESA Dispute."
[30] Pierre Sparaco, "ESA Members Ratify Galileo Kickoff," *Aviation Week and Space Technology* 157, no. 26 (December 23, 2002): 35.
http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=271518251&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD. (accessed January 8, 2008). And ESA, "Galileo: break in Negotiations," December 23, 2002. www.esa.int/esaCP/ESAAJ58708D_index_2.html (accessed January 7, 2008).
[31] Peter b. de Selding, "One More Time: ESA Tries to Put Galileo on Track," *Space News* (January 2003): 3.

for Europe. The entire space industry in Europe will badly suffer from a break in the negotiations."[32]

Germany then staked out the position that the return to ESA Member States' national industry should be based on GNP, rather than on their total contribution. Of course, such a move would benefit Germany the most.[33] Germany was motivated by concern about the survival of its aerospace industries which had entered a severe downturn in business.

National level interest in pride and prestige as well as national and industrial-level interests in relative gains were slowing down European-level considerations for strategic independence and European-wide mutual economic gains. The year 2002 closed without Galileo's Development Phase getting fully underway.

January – December 2003: *Gaining momentum on all fronts*

Negotiations continued and by March 2003 a new agreement was proposed. The largest industrial share would be given to Germany, the future Galileo operating company would have its headquarters in Germany, and the CEO of the future operating company would be named by the German dominated EADS Astrium. Italy would be the lead project manager and key technical facilities and system engineering tasks would be placed in Italy.[34] However, this agreement quickly collapsed later in March over

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[32] ESA, "Galileo: Break in Negotiations," ESA, December 23, 2002. http://www.esa.int/esaCP/ESAAJ58708D_index_0.html (accessed March 8, 2008).

[33] Gustav Lindstom and Giovanni Gasparini, "The Galileo Satellite System and its Security Implications," April 2003, 15.

[34] Michael A. Taverna, "Galileo Nears Denouement Barring a Last-minute Breakthrough, the EC is Ready to Launch Development on its Own, Leaving ESA on the Sidelines For Now," *Aviation Week and Space Technology*, 158, no 13 (March 31, 2003): 40. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=321072971&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD. (accessed January 8, 2008).

questions of who would have the lead in satellite engineering, development, and production. Likewise, Spain was still unsatisfied. The ESA deadlock continued.

When it became clear that a compromise could not be worked out, ESA cancelled the scheduled March 26, 2003 ESA Council meeting. At this point the EC threatened to go ahead with full-scale Galileo development, including spacecraft development (which was ESA's turf) without ESA. Galileo's tight timelines prohibited further delay. EC Vice President Loyola de Palacio and the EC transport ministers, including those from Italy and Germany, agreed that they could not wait anymore for the research ministers who made up the ESA Ministerial Council to get their act together.[35] This was a threat to ESA. An EC go-ahead without ESA would be considered another blow to ESA's prestige and would "further consecrate" the EC's growing role in space, defense, and other strategic policy matters.[36]

Significantly, the EU's development of the ESDP had been gradually picking up momentum since the start of Galileo's Development Phase. European military capabilities assessments were conducted in this timeframe and the EU had continued to pursue its development of the Rapid Reaction Forces. In fact, in March 2003 EU forces replaced NATO peacekeeping forces in the Balkans. While not directly linked to Galileo, these EU activities indicate some of the influences weighing on European decision-makers' minds when making decisions concerning Galileo.

In fact, the EC and the Greek Ministry of Defense sponsored a meeting in Athens on May 8-9, 2003 at which the military uses of space were discussed. John Davey,

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And Gustav Lindstom and Giovanni Gasparini, "The Galileo Satellite System and its Security Implications," April 2003, 17.

[35] Taverna, "Galileo Nears Denouement."

[36] Taverna, "Galileo Nears Denouement."

Chairman of the Galileo Security Board, noted that some had reservations regarding Galileo's military aspects. However, he questioned whether the continued public description of Galileo as a "civil program under civil control" was appropriate, given the fact that in a conflict Galileo managers reserved the right to deny access to Galileo. He noted that the Galileo system operator's priorities to provide commercial services might conflict with the Galileo Security Monitoring Center or the Galileo Security Authority's priorities. Nevertheless, he pointed out that there was still no clear organizational structure for handling Galileo security structures.[37]

On May 26, 2003, the ESA funding dispute was finally resolved when it was agreed that Germany, Italy, the United Kingdom, and France would each receive a 17.3 percent share in the program versus the 17.5 percent proposed in October, and Spain would get 10.3 percent instead of 9.5 percent.[38] Other countries shared the remaining 20 percent. The physical locations of major facilities were agreed to as outlined in the proposed March compromise.

ESA leaders were embarrassed that seven months were lost over what turned out to be such relatively modest differences.[39] Any potential gain in industrial contracts was probably lost due to the program delays caused by this squabbling. In 2005, ESA estimated that delays cost 1 million Euros lost per day.[40] This may indicate that national

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[37] Peter B. de Selding, "Europe's Growing Appetite for Military Space" Space News, (May 27, 2003). http://www.space.com/spacenews/archive03/agencyarch_052703.html (accessed March 15, 2008).
[38] Michael A. Taverna, "Burst of Life Galileo Satnav System is Given the ESA Green Light, While the A400M Finally Heads Toward Reality," *Aviation Week and Space Technology* 158, no. 22 (June 2, 2003): 26. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=344218751&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD. (accessed January 8, 2008).
[39] Taverna, "Burst of Life." Note: two tenths of a percent of 550 million is just a bit more than one million euros.
[40] Space News, "Editorial: Quit Stalling Galileo."

pride and prestige were the most significant influence on this group of European leaders during this period.

The agreement also allowed the GJU to be formally established in Brussels in June 2003, becoming fully operational on September 1, 2003.[41] As noted earlier, its purpose was to manage the Galileo's Development Phase and select a concessionaire to manage the Deployment and Operational Phases. Its first task was to issue the initial contracts for Galileo.

The GJU quickly approved contracts for the first two test satellites. The contract for the first satellite was with Surrey Satellite Technology Ltd in the United Kingdom.[42] It needed to be launched by the end of 2005 in order to secure Galileo's frequencies per the ITU agreement discussed in Chapter Five. Galileo Industries SA received the contract for the second satellite which was to be launched in mid-2006.[43] Soon thereafter, the GJU issued a tender for the Galileo concession.

In the meantime, ESA prepared structurally for its involvement in security and defense-related space projects. The ESA Security Committee, ESA Security Office, and ESA security regulations were established during the 2002-2004 time period. ESA was adjusting to the new interest in Europe on security space activities and on the potential for such activities to boost the European space industry. On 1 December 2003, the new (as of 1 July 2003) ESA Director General Jean-Jacque Dordain produced an internal position paper which explicitly stated that ESA now interpreted "peaceful purposes" to

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[41] Annati, "Galileo VS. GPS," 88.
[42] Peter B. de Selding, "Firms Selected to Build Initial Galileo Navigation Craft," *Space News*, (June 20, 2005). http://www.space.com/spacenews/marketmonitor/Surrey_0620.html (accessed March 15, 2008).
[43] "In-orbit validation Contract: A further Step forward for Galileo," *SpaceDaily*, December 22, 2004. www.spacedaily.com/news/gps-euro-041.html (accessed December 22, 2004).

mean “non-aggressive.”[44] This officially opened the door in ESA to much more participation in security related projects, especially dual-use projects such as Galileo. The fact that European decision-makers at ESA were able to overcome this major institutional taboo, enshrined in its convention, seems to indicate that realist factors began to pervade the environment in the European space sector during this period.

October 2003 was a significant month in the annuals of the European space sector. Worryingly perhaps, from the European perspective, the first Chinese taikonaut flew in space. The Chinese manned space flight program had been approved in 1992. Starting nearly from scratch, in a relatively short time – nearly the same amount of time the EU decision-makers had been discussing Galileo – the Chinese developed the skills and made the investments needed for the development and deployment of key military and civil space technologies.[45]

In addition, on October 30, 2003 the EU and China signed an agreement that allowed China to cooperate in the Galileo program. China indicated its willingness to contribute 200 million euros to the project. Chinese participation and funding would be managed through the GJU and give China a seat at the table in the GJU.

This series of actions was perceived by some in the United States as demonstrating that the EU was using cooperation with China as a tool to balance the United States.[46] Given the on-going dispute over Galileo’s PRS signal and the overlay of the GPS III military code, and the potential that China (despite EU assurances) could someday get access to Galileo’s PRS encryption keys and other sensitive technology, the

[44] European Space Agency Council, “Position Paper on ESA and the Defense Sector,” 7-8.
[45] Carl Bildt and Mike Dillon, “Europe’s Final Frontier,” in *Europe in Space*, (London, Centre for European Reform, October 2004), 16.
[46] Joan-Johnson Freese and Andrew S. Erickson, “The Emerging China-EU partnership: A Geotechnological Barrier.” *Space Policy* 22 (2006): 13, 19.

United States viewed the development of a close Sino-European working relationship as another cause for concern with Galileo and Europe's course.[47] However, it must be noted that the majority of European efforts to assist China technologically are economically driven and uncoordinated. Therefore, it is difficult to argue that the EU and ESA via the GJU consciously agreed to cooperate with China for the purpose of balancing the United States. Also recall that October 2003 was the point at which EU-U.S. negotiations over Galileo and GPS began to move, when the EU agreed to relocate the PRS signal.

In early November 2003, the EC released the *White Paper: Space: a new European frontier for an expanding Union, An action plan for implementing the European Space Policy*. This key document provided the foundational argument for moving European space policy efforts forward. Among many other topics, the section on Galileo stressed Galileo's commercial and civil benefits. However, a relatively lengthy section on how crucial space capabilities were in support of the EU security and defense policy emphasized that: "Space technology, infrastructure, and services are an essential support to one of the most rapidly evolving EU policies – the Common Foreign and Security Policy including the European Security and Defense Policy." It continues

> The European Union Military Committee has clearly stated that space assets can be efficient tools for crisis management operations. For its part, the EU Political and Security Committee has recommended further reflection on how to ensure that security and defence aspects are taken into account in the determination of EU space policy and its programmes.[48]

[47] Joan-Johnson Freese and Andrew S. Erickson, "The Emerging China-EU partnership: A Geotechnological Barrier." *Space Policy* 22 (2006): 19. Also see Lindstrom and Gasparini, "The Galileo Satellite System and its Security Implications.".29.
[48] European Commission, *White Paper,* 16.

Therefore, a careful reading of the White Paper shows that while the commercial and civil aspects of Galileo are highlighted in this document, a large but veiled emphasis is on Galileo's potential security and defense contributions.

Also in November 2003 the EU expanded Galileo's international participation when the EU initialed an agreement with India for cooperation in the Galileo partnership.

January 2004 – December 2004: Clearing obstacles (except for the most important)

On 14 January 2004 President Bush announced a new vision for America's space exploration program which committed the United States to a long-term human and robotic program to explore the solar system, starting with a return to the Moon.[49] While this announcement and China's successful manned space flight in October 2003 are not directly related to the Galileo program, they are important aspects of the context in which decisions about Galileo were made. It is reasonable to assume that the capabilities and ambition the Chinese and Americas were demonstrating bolstered their prestige while Europe was relegated to watching from the sidelines as Galileo, Europe's flagship space program, remained stalled.

The European Parliament confirmed the importance of Galileo in its 29 January 2004 resolution in which it stressed "the enormous significance of Galileo for the European Union's industrial, transport, technological and environmental development, and hence at the same time for the achievement of the strategic goals set in Lisbon of

[49] Office of the Press Secretary, White House Fact Sheet "President Bush Announces New Vision for Space Exploration Program, January 14, 2004. http://www.whitehouse.gov/news/releases/2004/01/20040114-1.html

making the Union the most competitive and dynamic economic area in the world."[50] Also recall that in late January 2004, the United States and the EU agreed on the compromises necessary to make Galileo and GPS compatible and interoperable. The sequence of events in the later part of 2003 and early 2004 serve as a good illustration of the competing rationales for the Galileo program.

Meanwhile, the EU continued to grow and strengthen economically and militarily during Galileo's Development Phase. In May 2004 the EU expanded from 15 Member States to 25 Member States. The strength of the euro, (which had been fully introduced on 1 January 2002), and the growth of the EU to 25 states with an internal market of nearly half a billion people underscored the EU's economic weight, while the Lisbon Strategy indicated European leaders' desire to be the number one economic power in the world.

However, the situation in the European space industry, a vital high technology "knowledge economy" sector, had not stabilized. Eurospace released a report in 2004 which noted that the European space industry situation, while dire, would have been even worse if not for a 10.6 percent increase in demand for space services from the public sector in Europe and a "remarkable" surge in demand for military space applications.[51] The report also noted that, "Navigation activities are slow to take off, [but] the Galileo program is expected to represent an important new flow of revenues between 2004 and 2008."[52] To be operational by 2008, Galileo would create the demand for thirty new

[50] EC, *Proposal of the European Parliament and the Council*, COM(2004) 477 final (Brussels, EC, July 14, 2004), 2.
[51] Shirvanian, ed. *2004 European Space Directory,* 12.
[52] Ibid., 13.

satellites and a corresponding number of launches. Naturally, the space industry was eager to profit from this potential bonanza of future contracts.

However, the slump in the commercial space market during this period also illuminates why it was so difficult to get the space industry (or indeed any private sector entity) to commit to funding a significant portion of Galileo's development and deployment.[53] It is reasonable to argue that the industrial situation affected EC decision-makers in their assessments of the need for Galileo by making them aware that the European space industry needed the business offered by Galileo in order to survive.

The Panel of Experts on Space and Security (called for in the *White Paper*) held its first meeting in 7 June 2004. It consisted of space and security experts from both EU Pillar Two and Pillar One (including the EC Directorate Generals for Research; Enterprise; and Energy and Transport), all 25 EU Member States, national space agencies, ESA, EUMETSAT, the EU Satellite Center, Eurocontrol, and the space industry. The task of this panel was to identify where security requirements could or could not be met by existing civilian assets and to make recommendations on how to incorporate defense, technological, legal, and institutional requirements in the developing European Space Program. This included assessments on the number and type of satellites the EU needed, the roles of different actors, and the establishment of working relationships between the previously starkly separate civil and defense related space sectors. The panel delivered its *Report of the Panel of Experts on Space and Security* in March 2005. The report said "Europe must establish a new balance between civil and military uses of space. There is little point in concentrating on purely civil applications

[53] Thanks to Dr. John Logsdon for pointing out the significance of other private sector entities besides the space industry.

and ignoring military requirements or vice versa. Greater emphasis should therefore be placed on supporting the security authorities of the Union." It emphasized the role of space systems, including dual-use systems, as vital components of overall European security.[54]

Later in June 2004 the EU - U.S. agreement on Galileo cooperation was signed. The European Economic and Social Committee also noted in June "the fact that the Galileo project is of major strategic importance to the European Union, to the future of its space industry, and to the cause of promoting European integration."[55]

On 12 July 2004 the European Defense Agency (EDA) was founded as an agency of the European Union. In support of the EU Member States and the Council, its purpose is to coordinate the EU's defense industry by supervising the development of military capabilities, research, and armaments.[56] Its functions include: develop defense capabilities; promote Defense Research and Technology (R&T); promote armaments co-operation; create a competitive European Defense Equipment Market and strengthen the European Defense, Technological and Industrial Base. Organizationally, it falls within Pillar Two's purview and it is headed by the EU High Representative, Javier Solana, who is Chairman of the Steering Board. The Steering Board is its decision-making body and is composed of Defense Ministers of the Member States and members of the European Commission including Gunter Verheugen, Vice President of the EC responsible for the Enterprise and Industry Directorate-General, whose portfolio includes the arms industry

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[54]EC, *Report of the Panel of Experts on Space and Security*, (Rome, EC, March 2005). http://www.docstoc.com/docs/957501/REPORT-OF-THE-PANEL-OF-EXPERTS-ON-SPACE-AND-SECURITY (acessed June 5, 2007).

[55] EC, *Proposal of the European Parliament and the Council*, COM(2004) 477 final (Brussels, EC, July 14, 2004), 2.

[56] Roxana Triron, "European Defense Agency Raises Hackles in U.S." *National Defense Magazine*, August 2004. http://www.nationaldefensemagazine.org/article.cfm?Id=1547 (accessed March 16, 2008).

and responsibility for EC space policy.[57] In fact, the EDA and the EC endeavored to lesson inter-pillar fragmentation by jointly developing a mechanism to coordinate between defense-related and civil security research, and to coordinate between European and national level security research.

Nevertheless, EDA has a limited mandate and budget. It is not connected directly to the Galileo project and is not heavily involved in European space initiatives. However, EDA quickly found that Galileo (and GPS) and other space capabilities cut across its primary functions (noted above). EDA could do little without taking space capabilities into account.[58] The creation of EDA is another indicator that realist factors were influencing European decision-makers' perspectives and EDA's finding that space was integral to the development of European military capabilities further confirmed the importance of Galileo's multi-use capabilities.

The same day that EDA was a founded the European Council established the GNSS Supervisory Authority (GSA) for the management of Galileo and EGNOS. At this time the GJU was in the process of soliciting bids for a concessionaire to take charge of the Deployment and Operational Phases. Once the GJU had selected the concessionaire, the plan was for the GJU to be disbanded and its operations and assets were to be folded into the new GSA.[59]

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[57] Gunter Verheugen, "Joint Approach to Security Research," speech to the Research and Technology Conference, Brussels, BE, February 9, 2006. Agence France-Presse,"France in Consultations with EU over Revival of European Defense," AFP, Paris, September 26, 2007.

[58] Octavia Froda, EDA, interviewed by author, Brussels, BE, September 20, 2007. Also see Security and Defense Agenda, *Is Europe Getting Serious About Space and Security*? SDA Monthly Roundtable, October 16, 2006, (Brussels: Security and Defense Agenda, 2006), 5. Pierre Hougardy, EDA Director of Capability for EDA said based upon EDA's capability driven approach, space cut across all the following sectors: command, inform, engage, protect, deploy, and sustain.

[59] European Union, "Establishment of Structures for the Management of the European Satellite Radio-navigation Programmes," 1.

On 13 July 2004 the EC signed a cooperation agreement with Israel. The agreement provided for cooperative activities in a wide range of sectors, notably science and technology, industrial manufacturing, and service and market development. Contracts with Israeli entities would include infrastructure and application oriented activities. As a result of this agreement Israel committed 18 million euros to Galileo's Development Phase in 2005 and Israeli became a member of the Galileo Joint Undertaking.[60]

In 2004 Barry Posen in "ESDP and the Structure of World Power" argued that the ESDP appeared to be a reaction to the hegemonic position of the United States and stated that, "Viewed from this light, ESDP is a form of balance-of power behavior, albeit a weak form." He went on to predict that a more militarily autonomous Europe appeared viable in less than ten years and counted Galileo as a future European military capability.[61] He also noted that a 2002 German Marshall Fund Poll found that 55 percent of Germans polled said that the EU was more important than the United States to Germany. After the United States invasion of Iraq the same poll conducted in 2003 found that 81 percent of Germans said the EU was more important. This is significant because German support for the ESDP was crucial for making the ESDP credible. The ESDP was originally based upon the 1998 Franco-British Saint Malo initiative. In contrast, Germany had continued to look to NATO and the United States as the most

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[60] "Galileo, European Satellite Navigation System." http://www.delisr.ec.europa.eu/english/content/technology_section/1.asp?id=4 (accessed March 19, 2008).
[61] Barry Posen, "ESDP and the Structure of World Power," *International Spectator* 39, no. 1 (January 2004): 17.

important relationships. Now it appeared Europe, taken as a whole, shared the idea that the EU should become a superpower, shaped for balancing the United States.[62]

On 4 September 2004 two consortia presented their concessionaire bids to the GJU.[63] EURELY was the consortium founded by Alcatel, Finmeccanica, and Vinnci. In national terms, observers considered this consortium to be weighted in favor of France, Italy, and Spain. In effect it represented “Southern Europe.” The second consortium was iNAVSAT which was founded by EADS Space, Inmarsat, and Thales Group. Observers considered this “Northern European” consortium to favor Germany, England, and France.[64]

Initially, the winner was to be selected by the end of September 2004 and the decision was to be confirmed by the EU Transport Council in its December 2004 meeting. After that, detailed contract negotiations with the winning consortium were to begin. Even so, the Head of the GJU admitted that the Galileo project was a year behind schedule. However, he had not given up hope that the project could still be operational by 2008. He said that getting back on schedule would depend on the proposal from the winning concessionaire.[65] However, it was widely thought that negotiating the complex concessionaire agreement would take much longer. An advisor to the EURELY consortium said he thought talks could be completed “within a year” but admitted it

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[62] Alse Toje, “The 2003 European Security Strategy: A Critical Appraisal,” *European Foreign Affairs Review* 10 (2005): 129. Also see Hill, “*The Common Foreign and Security Policy of the European Union*.”
[63] Commission of the European Communities, “Opinion of the European Economic and Social Committee On the Proposal for a Regulation of the European Parliament and the Council on the Implementation of the Deployment and Commercial Operating Phases of the European Program of Satellite Navigation,” COM (2004) 477 final, *Official Journal of the European Union*, (Brussels: EU, September 8, 2005).
[64] Mark Holmes, “Galileo Joint Undertaking Denies Consortia Being Pushed Together,” *Satellite News* 28, no. 12 (March 21, 2005). http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pqdweb? did=810809321&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD (accessed January 8, 2008).
[65] Michael Taverna, “Galileo Preview: EGNOS Overlay System Will Provide Peek at New SATNAV Capability,” Aviation Week & Space Technology 116, no. 11(September 20, 2004): 52.

might take almost two years, i.e. until the summer of 2006. This reinforced doubts that Galileo would not be operational as scheduled in 2008 and might not occur until 2009/2010.

Shortly thereafter, on 4 October 2004 the GJU declared the two bids to be qualitatively even and set a January deadline for receipt of additional information.[66] That meant that there would be no decision at the December EU Transport Council meeting.

Industry officials said that both bids made clear that European governments would be required to accept much of the financial risk if Galileo failed to be commercially profitable.

Meanwhile, the EC continued to negotiate international cooperative agreements in order to spread Galileo costs as widely as possible. In addition to the agreements with China and Israel, serious discussions were underway with Russia, Ukraine and India. Likewise, talks were begun with South Korea, Australia, Mexico and Brazil, as well as financial participation from ESA members Switzerland, Norway and Canada.[67] The EC expected a significant contribution from these cooperating countries and corresponding access to their markets.[68]

In order to streamline EU management, in December 2004 the 25 EU countries at that time signed the "*Constitutional Treaty of Europe*." The Constitution would also improve the EU's ability to act internationally by creating a European President and a European Foreign Minister, and would give the EU a legal identity to enable its

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[66] Peter B. De Selding, "Selection of Galileo Operator Deferred," *Space News* (October 5, 2005). http://www.space.com/spacenews/europe/galileo_030105.html (accessed January 14, 2008).
[67] Canada is an Associate member of ESA.
[68] Commission of the European Communities, *Communication from the Commission to the Parliament and the Council: Moving to the Deployment and Operational Phases of the European Satellite Radionavigation Programme*, COM (2004) 626 final, (Brussels: EC, October 6, 2004), 6.

participation in International Organizations such as the World Trade Organization. However, the treaty failed the ratification process when voters in France and the Netherlands rejected it in mid-2005. Nevertheless, it is significant because space was included in the treaty as a core "shared" competence of the EU which would make space a major EU policy area and give the EU the power to define and implement programs related to space.[69] Furthermore, it confirmed the shift in policy-making responsibility from ESA to the EU. In addition, it mandated the creation of a European Space Policy. By signing this treaty the political leadership of the European Union had acknowledged that the European space sector fell firmly within the auspices of the EU and should be positioned to support EU policies including the EDSP. However, until some EU legislation comes into force such as the failed *Constitutional Treaty* or the 2007 *Reform Treaty* (stalled while going through the ratification process at this writing) which confers an explicit competence for space to the EU, the EC was bound to rely on competencies that are connected to space (such as Transport or Research) in some way.[70]

On 10 December 2004 the European Transport Council released 150 million euros in initial funding needed to begin construction and launch of the first four operational Galileo satellites which would serve as the on-orbit validation of the Galileo constellation.[71] ESA and Galileo Industries subsequently signed a contract to begin

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[69] Jens-Peter Bonde, ed., *The Constitution – reader friendly edition*, 8-9. http://european-convention.eu.int, (accessed August 5, 2004). The Constitution added new shared competences in research, technological development, space, development cooperation and humanitarian aid. EU, "The Union's Founding Principles: Classification and Exercise of Competences." Fact Sheet, http://europa.eu/scadplus/constitution/competences_en.htm (accessed May 26, 2008).

[70] S. Hobe and J. Neuman, "Global and European Challenges for Space law at the Edge of the 21st Century." *Space Policy* 21 (2005): 314.

[71] Michael A. Taverna, "Galileo Gearing Up; Dem/val Award Sets Stage for Concession Deal, but Deployment Will be Two years Late," *Aviation Week & Space Technology* 162, no. 1 (January 3, 2005): 27.

building the satellites.[72] An additional 950 million euros to fully fund the four satellites was expected to be approved within six months.[73]

The Transport Council also approved moving Galileo from the Development Phase to the Deployment Phase "subject to a ***risk allocation***, including the final costs, acceptable to the public sector." [74] [Emphasis added]. It also asked that the process for the selection of the concessionaire be finalized by the end of February 2005 and that negotiations and selection of the concessionaire be completed during 2005.

In conjunction with this decision, the EC Directorate-General for Energy and Transport released a Galileo Information Note. This note re-emphasized that Galileo was a civil program under civil control and highlighted the commercial and civil importance of Galileo. It acknowledged the possibility of military use but downplayed that prospect by saying that "Military use of Galileo would have to be decided by the Member States in the framework of the Common Foreign and Security Policy." However, it also states:

> With Galileo, the European Union is enlarging its competencies in the field of foreign policy. For the first time, it will have control of a strategic infrastructure as part of the Common Foreign Security and Defense policy [sic]. The Community method [supranational decision-making] has been introduced in areas reserved for intergovernmental cooperation up to now [Pillar Two]. [75]

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[72] Space Daily, "In-orbit Validation Contract: A Further Step Forward for Galileo" *Space Daily*, December 22, 2004. http://www.spacedaily.com/news/gps-euro-041.html (accessed April 3, 2008).Also BBC, "Europe Presses Ahead on Sat-nav," *BBC News*, December 10, 2004. http://newsvote.bbc.co.uk/mpapps/pagetools/print/news.bbc.co.uk/2/hi/science/nature/4084508.stm (accessed December 12, 2004).
Also see Space Daily "EU Transport Ministers Okay Galileo Satellite Tracking System," *Space Daily*, December 10, 2004. www.spacedaily.com/news/gps-euro-041.html (accessed April 3, 2008).
[73] Taverna, "Galileo Gearing Up."
[74] Council of the European Union, "Transport, Telecommunications and Energy," 2629th Council Meeting, Press Release, 15472/04, (Brussels: EU, December 9, 2004), 35.
[75] EC Directorate-General for Energy and Transport, "Galileo: The Final Countdown" Information Note, (Brussels, EC, December 2004), 3.

In effect, the Galileo program had real implications for the CFSP and ESDP, but with the EC at the control levers. Galileo was contributing to the erosion of the barrier between the first and second pillars of the European Union.

The Annex to this Information Note also held some important remarks. It explains again the potential income streams for Galileo without mentioning the controversy and subsequent agreement with United States in which it declares that it will not be necessary to impose a surcharge on Galileo receivers. Likewise it comments in passing that the EC will "promote" the use of Galileo in the areas under EC authority but it does not mention "mandating" its use; previously the EC had declared the intention to do so.[76]

Hence, a close reading of this December 2004 document detects a subtle shift in Galileo's direction. The civil and commercial aspects of Galileo were highlighted as usual but the removal of two key potential income streams diluted its commercial potential. The acknowledgement that the EC would control an important tool for the CFSP and ESDP was also a harbinger of the direction the project would eventually take.

Nevertheless, by the end of 2004 many of the issues that had been slowing down Galileo's development seemingly had been resolved. The cooperation agreement with the United States allowed the Galileo project to move beyond the PRS and frequency overlay dispute. Additionally, GPS III now wasn't expected to be operational before 2015. This gave the Galileo project a few extra years of breathing room to become operational before having to compete with GPS III.[77] Likewise, the earlier ESA funding shares dispute had apparently been resolved. Moreover, the EU and ESA had developed

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[76] Ibid., 7-8.

[77] Michael A. Taverna, "Galileo's Slow Start," *Aviation Week & Space Technology* 160, no. 25 (June 21, 2004): 43. Taverna attributes this point to Bernard Mathieu, Head of CNES radio satellite communication.

a framework within which to work together. Progress was being made in the development of an overall European space policy within which Galileo would be an important piece. International cooperation initiatives were underway with China and Israel which helped to spread the costs and risks of Galileo's development. Many other countries were clamoring to get on board. Even the controversial security and defense concerns caused by Galileo's multi-use capabilities had dampened. The primary unresolved issues that remained were the financial and management arrangements for the Deployment and Operational Phases and above all, the awarding of the Galileo concession.[78]

January 2005 to December 2005: Location, location, location

In 2005[79] however, continued debates regarding the distribution of gains, Galileo's questionable business case, and the project's first major cost overrun stymied progress.

The GJU did not finalize the concessionaire selection process in February 2005 and negotiations between the GJU and the concessionaires continued. Rumors arose that the EC had intervened in order to create a "fusion" proposal that would balance the concession geographically.[80] In fact, the composition of the two consortiums put the GJU in a difficult position. As mentioned previously, the iNAVSAT consortium included EADS Space, Thales, and Inmarsat which represented strong German, French,

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78 Holmes, "Galileo Joint Undertaking Denies Consortia Being Pushed Together."
79 The number of sources available drops dramatically from 2005 to the end of the period of this study. In fact, no relevant EC official documents or EC Communications to the Parliament or Council were publicly released in 2005. Therefore, information about events in 2005 relies heavily upon contemporary journalistic accounts from specialist media, primarily Aviation Week and Space Technology, GPS World, and Space News.
80 GPS World, "Two for One as Galileo Competitors Combine," *GPS World* (July 2005): 14.

and British space industry interests. Therefore, if the GJU selected the iNAVSAT consortium, Italian interests would be left out. As Italian political and financial support for Galileo was vital, this would not be workable. Likewise, the EURELY consortium did not represent German space industry and Germany would be left out if EURELY were selected. Industrial level and national level interests had to be satisfied before the project could move forward.

Observers speculated that there was a push for the two consortia to merge. There was no other way to overcome the distribution of gains issues. Nevertheless, the GJU executive director, Rainer Grohe, denied these rumors but said the GJU would consider it if the two consortia decided to merge on their own.[81] Indeed, at the end of April European governments asked the two consortia to merge their bids.[82]

Not surprisingly, in May the two consortia stated that they intended to join forces and on 20 June 2005 the two consortia provided a joint bid. A week later the GJU selected this bid as the winner over the separate bids and the two consortia joined together.[83] The "Merged Consortium" as it was called was also named the Galileo Operating Consortium (GOC) and later named Euro-GNSS.[84]

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[81] Holmes, "Galileo Joint Undertaking Denies Consortia Being Pushed Together."
[82] Peter B. de Selding, "Europe Eliminates Galileo Competition; Requests Single Industry Proposal," *Space News* (April 30, 2006). http://www.space.com/spacenews/spacepolicy/webgalileo_061505.html (accessed January 9, 2008).
[83] GPS World, "Two for One as Galileo Competitors Combine," *GPS World*, (July 2005), 14.
[84] The merged consortium was located in Toulouse but never incorporated as a company. Michael A. Taverna, "United We Stand: ESA, EC See Way out of Galileo Impasse, Start GMES Procurement as Common Space Policy Kicks In," *Aviation Week & Space Technology* 166, no. 17 (April 30, 2007): 30. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=1274625361&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD. (accessed January 8, 2008). Also, Commission of the European Communities, *Communication from the Commission to the European Parliament and Council: Galileo at a Cross-Road*, COM (2007) 261 final (Brussels: EC, May 16, 2007), 4.

Germany and Italy both indicated that one of Galileo's the three major ground facilities must be located in their country.[85] It was now hoped that negotiations with the new combined concessionaire and work share agreements with European states and third party contributing states could be completed by the end of 2005. ESA estimated that Galileo's costs would rise 1 million euros per working day that negotiations dragged on after January 1, 2006.[86]

Meanwhile, the Galileo program had run up 400 million euros in cost overruns. These overruns were caused by more than a year of delay in starting Galileo contract work, additional signal security requirements, management requirements, and GPS – Galileo compatibility requirements.[87] Unsurprisingly, both ESA and the EC balked at paying their 50 percent share of the cost overruns.[88] Eventually the EC scraped together its share of the additional funds. But it was a different story at ESA.

Germany used the budget shortfall as leverage in negotiations and insisted that it would not approve extra payments to cover the cost overruns until it was certain that a Galileo control center and the headquarters of the yet-to-be-selected private consortium to manage Galileo would be in Germany.[89] Germany also was negotiating to have DLR as a shareholder in the merged consortium. Other European governments objected to this

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[85] Michael A. Taverna, "Going Together; Political Wrangling Continues Despite Agreement on Joint Concession Bid for Galileo," *Aviation Week & Space Technology* 163, no.1 (July 4, 2005): 28.
[86] "Editorial: Quit Stalling Galileo," *Space News* (July 5, 2005). http://www.space.com/spacenews/archive05/Editorial_070505.html (accessed December 17, 2007).
[87] Michael A. Taverna and Robert Wall, "Two Steps Forward," *Aviation Week &Space Technology* 163, no. 10 (September 12, 2005): 53. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=896354321&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD. (accessed January 8, 2008).
[88] Space News, "Editorial: Quit Stalling Galileo."
[89] Peter b. de Selding, "As Galileo Finances Tighten Europe Spreads the Burden," *Space News* (June 20, 2005).

effort, saying that a private company should not have a government shareholder and especially not from just one nation.[90]

Italy also objected to paying for the cost overruns through ESA, arguing that Galileo's security-related requirements came from the EC and amounted to nearly 50 percent of the cost overruns.[91] Italy argued that the EC should bear the full cost.[92] The United Kingdom, Spain, and Finland were also dissatisfied. This squabbling at ESA continued through the summer and autumn of 2005.

The dispute over the cost overrun delayed concession negotiations even though the two issues were unrelated. It also delayed the final contract for the four In-Orbit Validation (IOV) satellites and work on the Galileo ground network. Galileo Industries said that the four IOV satellites would not be ready until 2008. According to *Aviation Week & Space Technology*, it was now "commonly admitted" that Galileo would not be fully operational before 2010-2012, but officially it was still supposed to be operational by 2008.[93]

The main issue again came down to the location of key ground infrastructure facilities. By October 2005, Germany, the United Kingdom, and Spain were still holding up approval at ESA and negotiations had deadlocked. Germany was the biggest contributor to Galileo but did not believe it had secured a guarantee on the return for its investment, even though it had expressed its concerns repeatedly over a significant length of time. The German Transport Minister Manfred Stolpe threw down the gauntlet saying;

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[90] In contrast, the French Government has been a major shareholder in Arianespace.
[91] Peter b. de Selding, "Europe's Galileo Satellite Project Hits First Cost Overrun," *Space News* (June 7, 2005).
[92] Peter b. de Selding, "As Galileo Finances Tighten Europe Spreads the Burden," *Space News* (June 20, 2005)
[93] Taverna and Wall, "Two Steps Forward." Also see Taverna, Galileo Gearing Up."

> We will only free up additional resources when German interests are taken into consideration. We want the satellite control center and the inclusion of a German industrial entity [in addition to the Franco-German EADS], in the future Galileo consortium, as well as appropriate participation of German industry in building the system.[94]

Meanwhile, Germany and the other states concerned held parallel negotiations directly with the private concessionaires.[95] ESA Director General Dordain hoped that the final concession bid, due on October 21, would contain proposals for the lay out of the ground infrastructure that would break the deadlock.[96] However, the final concession bid stalled again and got pushed into early 2006.

Finally, in early December 2005 an EC mediator helped the sides reach a comprehensive agreement which would allow the release of the 950 million euros needed to complete the four IOV satellites. The agreement stipulated that the concessionaire headquarters would be in France; the operating center would be in the United Kingdom; the constellation, mission control, and performance evaluation facilities would be in Germany and Italy; and a back-up safety-critical service facility would be in Spain. A final decision on the location of the GSA would be decided after the concessionaire was in place.[97]

In addition, at German insistence a German joint company called TeleOp became the eighth member of the combined consortium. Thirty percent of TeleOp was controlled by DLR, 30 percent by EADS Space Services Germany, 25 percent by T-Systems (A German telecom operator), and 15 percent was controlled by a Bavarian investment bank.

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[94] Michael A. Taverna and Robert Wall, "ESA Rolls Out Plan B for Galileo," *Aviation Week and Space Technology* 163, no. 16 (October 24, 2005): 30.
[95] "Green Light for More Galileo Funding Delayed Again," *Aviation Week and Space Technology* 163, no. 11 (September 19, 2005): 22.
[96] Taverna and Wall, "ESA Rolls Out Plan B for Galileo."
[97] Michael A. Taverna, "Green Light for Galileo," *Aviation Week and Space Technology,* 163, no. 23 (December 12, 2005): 69.

TeleOp would guarantee Germany a strong say in how the system would be run even if Germany lost control of EADS, its former "national champion."[98]

On 28 December 2005 the Surrey Satellite Ltd experimental Galileo satellite, Giove-A, was successfully launched.[99] The Galileo program at last had a satellite in orbit. This meant that Galileo's ITU allocated frequencies were secured. Recall that the Galileo frequencies which had been negotiated at the ITU WRC in May 2000 would have been lost if the first Galileo satellite had not been launched and made operational before 14 February 2006.[100] The launch of Giove-A also meant that on-orbit testing of various Galileo technologies could commence.

Despite all the hard bargaining that had occurred in 2005, the Galileo program ended 2005 on an upbeat note. The EC described the Galileo program as "on-track" and EU, ESA, and national officials said that no more obstacles stood in the way of a final concession agreement.[101]

January 2006 – December 2006: The return of previously set aside issues

In January 2006 the final contract for the four IOV validation phase satellites was finally signed between ESA and Galileo Industries.[102] By September 2006 they were under

[98] Michael A. Taverna and Robert Wall, "Almost a Go for Galileo," *Aviation Week and Space Technology* 165, no. 12 (September 23, 2006): 56.
[99] Commission of the European Communities, *Communication from the Commission to the European Parliament and the Council: Taking Stock of the Galileo Programme*, COM (2006) 272 final (Brussels: EC, June 7, 2006), 2.
[100] Warner, "After Much Debate."
[101] EC, "Galileo on Track: Successful Launch of the Giove-A Satellite," Press Release IP/05/1712 (Brussels: EC December 28, 2005). http://europa.eu/rapid/pressReleasesAction.do?reference=IP/05/1712&format=HTML&aged=0&language=EN&guiLanguage=fr. And Taverna, "Green Light for Galileo."
[102] Commission, *Taking Stock*, COM (2006) 272 final, 2.

construction and tentatively slated for a late 2008 launch.[103] However, the rest of 2006 did not turn out well. Concession negotiations stalled, PRS issues resurfaced, and serious question about China's participation arose.

Negotiations on the final concession contract remained bogged down. The main issue was how Galileo's various risks should be allocated during the Deployment Phase when the consortium was supposed to provide two thirds of Galileo's financing. The United Kingdom and Germany insisted that Galileo's private interests should bear the majority of risk since they ultimately stood to commercially profit from Galileo. Germany and the United Kingdom did not want more public money to be used. In contrast, the consortium argued that Galileo's weak business case, the risk of launch failures, the uncertain regulatory environment, high-risk technological challenges, and the length of time before they would see a return on their investment (a decade) made the Galileo project too uncertain for private interests to bear the most risk.[104] Officially, nine "blocks" of risk were identified in negotiations: cost overrun, construction, performance, design, revenue and markets, deployment, coverage of project risks, compensation in the event of termination of the project, and refinancing.[105] The apportionment of risk within each block needed to be agreed upon. Negotiations on these points dragged on throughout 2006.

Meanwhile, in February 2006 the European Commission sponsored a security exercise that demonstrated the usefulness of European space capabilities in security

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[103] Taverna and Wall, "Almost a Go for Galileo."

[104] Dr. Xavier Bertran and Alexis Vidal, "The Implementation of a Public-Private Partnership for Galileo" (paper presented at ION GNSS 18th International Technical Meeting of the Satellite Division, Long Beach CA, September 13, 2005). Dr. Xavier Bertran was the Deputy Director of the Galileo Program within EADS Space services, France and was the bid manager for INAVSAT. Alexis Vidal was a Galileo project manager for EADS Space Services, France.

[105] Commission, *Taking Stock*, COM (2006) 272 final, 3.

scenarios outside of Europe.[106] The exercise was the culmination of a 15 month EC-industry collaborative study called "Advanced Space Technologies to Support Security Operations" (ASTRO+).[107] The successful exercise included an earthquake disaster in Poland (simulating a location outside of Europe), and included civil and military participants. A situation center was set up in Poland that integrated civil and military space capabilities including imagery, navigation, tracking, and communication capabilities. The European Geostationary Overlay Service (EGNOS) was used for navigation services – in effect simulating Galileo's future capabilities. Clearly, this security exercise was a tangible demonstration that Galileo's capabilities would be used for security purposes and by European military forces.

By June 2006 the GJU and the consortium were still far apart in their negotiating positions. On June 7, 2006 the Commission sent a communication to the European Parliament and Council, "Taking Stock of the Galileo Programme." This update of the Galileo program admitted that the question of the apportionment of risk was holding up negotiations. The main point of contention boiled down to how industry and the EC should share the risk if Galileo became a commercial failure.[108] Indeed, the serious doubts about Galileo's commercial viability which the Transport Council had been pressured to set aside in early 2002 rose to prominence again. The fact that GPS provided PNT services for free, and was improving those services, could not be ignored.

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[106] Telespazio News 2006, "ASTRO+ Final Demonstration Event, 10 March 10 2006," March 9, 2006. http://www.telespazio.it/news2006_3.html (accessed August 7, 2007). And Istituto Affari Internazionali, Defence and Security, "Advanced Space Technologies to Support Security Operations – ASTRO+", *Istituto Affari Internazionali*, http://www.iai.it/sections_en/ricerca/difesa_sicurezza/ASTRO/ASTRO+.asp (accessed August 7, 2007).

[107] EADS Astrium led a team of 18 participating organizations including Alcatel Alenia Space, French space agency CNES, German aerospace centre DLR, the European Union Satellite Centre, Indra Espacio, Telespazio and the Royal United Services Institute for Defence and Security Studies.

[108] Commission, *Taking Stock*, COM (2006) 272 final.

In addition, other bargaining positions complicated the negotiations. For example, while the EU had agreed to pay a portion of Galileo's future operating costs (with the rest coming from the revenue generated by Galileo), the consortium wanted the EU to help pay the costs of the large bank loan the consortium had to take out to finance Galileo's Deployment Phase. The consortium also wanted the EU to bear the full cost of replacing the Galileo constellation when its satellites were retired. The EU offered to pay an additional 1 billion euros between 2007 and 2013 to help the Galileo consortium achieve commercial success, but the consortium demanded 2.5 billion euros.[109]

Later in June 2006 new EC Transport Commissioner Jacques Barrot said that the EC was aware that the consortium was a monopoly industrial group, in effect, but the EC was determined not to bow to any of its unreasonable demands. He said, "I want to be very clear on one point. The commission is not ready to pay any price just to obtain Galileo. Galileo costs must be reasonable and allow us to see value for money."[110] He also said that balancing the risk was more important than the schedule and the Commission was prepared to delay Galileo's commercial start date to 2011 if that is what it took to secure acceptable contract terms. The willingness to delay Galileo in order to assure value for money and the ability of the risk allocation issue to thwart forward progress indicates that up to this point, efficiency and the profit motive still strongly influenced European decision makers' decisions with regard to Galileo's development.

As the Galileo project inched closer to fruition in 2006, other issues which had been set aside earlier became increasingly important. First, the tension between Galileo's military and civil rationales intensified and disagreement over Galileo's military uses

[109] Peter B. de Selding, "EU: No Blank Check for Galileo," *Space News* (June 19, 2006). http://www.space.com/spacenews/archive06/Prs_061906.html (accessed January 9, 2008).
[110] Ibid.

grew stronger. The British continued to insist that Galileo was strictly for civilian uses and reaffirmed that British forces would not use Galileo's PRS signal. Moreover, the U.K. still sought to deny the military use of the PRS signal by any European country. [111] This put the U.K. at loggerheads with France who said that it planned to use the PRS signal militarily. Germany remained undecided and the EC would not commit one way or the other.[112] However, in October 2006, EU Transport Commissioner Jacques Barrot said using Galileo for military and defense purposes would help pay for the infrastructure and should be considered. He also noted that the use of Galileo only for civilian purposes would not persist because European military forces required satellite navigation capabilities[113] In addition, Patrick Bellouard, Galileo program coordinator for the French Prime Minister's office, said that French government support for Galileo would be put into question if the EC decided to prohibit military use of PRS.[114]

In the meantime, policies and organizational structures related to the operation and use of PRS did not yet exist. The EC's Communication of 7 June 2006 noted that initial work on defining a policy had been started by the Galileo Security Board but many things still needed to be done to organizationally prepare for PRS services. For example, national level requirements for the use of PRS services needed to be developed and an authority to oversee national users needed to be designated. In addition, the GSA needed to draft "Guidelines for implementing PRS management rules in the Member States," "Common Minimum Standards for the use and management of PRS," and "Specification and Instructions for the Construction of PRS receivers." The goal was for the EC to

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[111] De Selding, "Britain, France at Odds."
[112] Ibid.
[113] Defense News, "A Military Role for Galileo," *Defense News*, October 12, 2006, http://www.defensenews.com (accessed February 15, 2008).
[114] De Selding, "Britain, France at Odds."

propose a plan to accomplish these tasks by the end of 2006 so that it would be possible to begin using PRS at the end of 2010.[115] The manner in which these requirements almost appear to be an afterthought in the Galileo project's planning indicates that the PRS signal, i.e. the military and security uses of Galileo, was not the highest of priorities at this point.

China's involvement with the Galileo project also came into doubt. In mid-2006, the Chinese revealed plans to build their own global satellite navigation system called "Compass" or "Beidou." Its design was very similar to the GPS and Galileo constellations. The Chinese also revealed their intention to overlay their military signal on the PRS signal and perhaps overlay the GPS military frequency as well. In addition to the security implications of this move it undermined Galileo's business case even further since it reduced the PRS signal's value.[116] Moreover China said that it would have a free open signal for commercial use.[117]

In fact, the China and Israel partnership agreements were due to expire at the end of 2006 when the GJU shut down. The GNSS Supervisory Authority was due to take over from the GJU at the start of 2007 and no plans were being made to extend the agreements. Agreements with other countries had never been finalized and there was no plan to do so. GSA was designed as a European-only management body. The fact that GSA's responsibilities included management of the PRS signal precluded non-European countries from involvement. Only European authorities would have access to PRS.

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[115] Commission, *Taking Stock*, COM (2006) 272 final, 7.
[116] Peter B. de Selding, "Europeans Raise Red Flags over Chinese Satellite Navigation Plan," *Space News* (June 12, 2006). http://www.space.com/spacenews/archive06/China_061206.html (accessed January 9, 2008).
[117] Judy Dempsey, "Funding Breakdown Throws Galileo Satellite Project Off Course," *International Herald Tribune*, May 9, 2007. http://www.iht.com/articles/2007/05/09/sports/galileo.php

China and Israel's 5 million euro deposits would be refunded, minus any expenses they had incurred.[118] In October 2006 India withdrew its participation in Galileo and began collaborating with Russia on an improved version of GLONASS.[119] The sudden withering away of Galileo's international cooperation goals at the end of 2006, after a decade of seeking a global civil navigation satellite project built with international cooperation, indicates that something had changed in how European decision-makers perceived the Galileo project[120] or how prospective partners viewed the Galileo project. The implications of this turnaround are explored in the analysis below.

Meanwhile, Galileo Industry's performance in building the second experimental Galileo satellite, Giove-B, came under review by ESA.[121] Giove-B was originally supposed to be launched before Giove-A was launched in December 2005. Then it slipped to late 2006. By the end of 2006 it was not expected to be launched until late 2007 or early 2008.[122] ESA convened three separate boards of inquiry to investigate why Galileo Industries had not been able to keep on schedule. Besides some considerable technical problems, organizational problems also contributed significantly to the delays. Galileo Industries combined all the big satellite prime contractors (Alcatel Alenia Space, 38 percent; EADS Astium, 38 percent; Thales, 12 percent, and Galileo Sistemas y

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[118] De Selding, "Europeans Raise Red Flags."
[119] "Will European Disagreements Leave Galileo Grounded?" *Spiegel Online*, March 7, 2007, http://www.spiegel.de/international/spiegel/0,1518,469913,00.html (accessed January 24, 2008).
[120] A variety of European officials interviewed consistently implied that the EC no longer wanted international partners due to security reasons. None stated that the break off in cooperation was initiated by the countries outside Europe.
[121] This section relies heavily on reporting of a January 17, 2007 press conference by ESA Director General Jean-Jacques Dordain. Reported by Peter B. de Selding, "ESA Considers Dissolution of Galileo Industries," *Space News* (January 26, 2007). http://www.space.com/spacenews/archive07/galileo_0122-3.html (accessed January 9, 2008). And Michael A. Taverna and Andy Nativi, "Giove B Forces Galileo Industries Review," *Aviation Week & Space Technology* 166, no. 4 (January 22, 2007): 32.
[122] It was successfully launched on 27 April 2008.

Servicios, 12 percent) – each the natural competitor of the other.[123] This created competitive stresses that undermined decision-making. In effect, each company was extremely reluctant to take direction from another company in the consortium. In addition, national level political pressure by Italy, Germany, France, Spain and the United Kingdom was put on ESA to strictly follow *juste retour* principles. Nevertheless, ESA was concerned that the four IOV satellites being built by Galileo Industries would face extensive problems and delays – as had happened with Giove-B. By January 2007, ESA Director General Dordain was considering forcing the dissolution of Galileo Industries.[124]

The GJU was dissolved at the end of December 2006 without a final concession contract being signed. The GSA, which had already begun initial operations, took over and was now responsible for negotiating the Galileo concession. Unsurprisingly, EU transport ministers could not even reach agreement on where the GSA headquarters was to be located. Eleven EU Member States wanted to host the GSA and no compromise was reached at the December 2006 Transport Council meeting.[125] Unwillingness to surrender national interests prevented the Galileo project from moving forward again. At the end of 2006 concession negotiations continued but it was uncertain if a deal could even be worked out by the end of 2007.[126]

Meanwhile, the commercial space market picked up in 2006. Arianespace signed contracts to launch 12 spacecraft in 2006, up 33 percent from what it had contracted for

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[123] GPS World, "Galileo Industries Told to Put House in Order," *GPS World*, January 23, 2007. http://www.gpsworld.com/gpsworld/article/articleDetail.jsp?id=399854 (accessed January 15, 2008).
[124] Galileo Industries was renamed "European Satellite Navigation Industries," (or ESN Industries) in early 2007. It dissolved at the end of 2007.
[125] Peter B. de Selding, "Galileo Oversight Group Remains Without a Home," *Space News*, (December 12, 2006). http://www.space.com/spacenews/europe/Galfailweb121206.html (accessed January 9, 2008).
[126] Ibid.

in 2005.[127] Arianespace revenues and earnings were expected to increase substantially in the coming years. Likewise, the demand for the construction of satellites also picked up in 2006. Improvement in the commercial space business climate may have undermined the consortium's bargaining position with the GSA. On the other hand, in January 2007 Thales prepared to take over Alcatel Alenia Space. That left EADS and Thales Alenia as the remaining space industry prime contractors in Europe. A potentially positive result of this merger was that each one of these firms had a foothold in each of the major European Galileo countries.[128]

2007: Galileo's near death experience

The context surrounding the Galileo program shifted significantly in 2007. First, after reportedly "dazzling" an American spy satellite with a ground-based laser beam in 2006, China conducted an anti-satellite (ASAT) weapon test in mid-January 2007 where it destroyed a target satellite with a ground launched kinetic kill vehicle. The technologically challenging ASAT tests not only demonstrated that China possessed a significant strategic capability, but that China considered space a strategic domain which could be contested militarily. The ASAT tests alarmed authorities in Europe and the United States. Since the global economy and NATO had grown increasing reliant upon space-based capabilities, the ASAT test was considered a significant strategic threat.

India and Russia had also increased public investment in their space activities. By 2007 India had demonstrated growing expertise in space and Russia had increased its

[127] Michael A. Taverna, "Capacity Crunch; Buoyant Demand Sets Stage for Another Strong Year at Arianespace," *Aviation Week & Space Technology* 166, no. 3 (January 15, 2007): 420.
[128] Taverna and Nativi, "Giove B Forces Galileo Industries Review."

civil space agency budget tenfold since 1999 so that, if compared "on an equal purchasing power basis," it was now at a spending level close to ESA's.[129]

Two French parliamentarians who had long been active as influential French and European space advocates, M.P. Christian Cabal and Senator Henri Revol, released a report in February 2007 in which they said that the space ambitions of China, India, Russia, Japan and the United States constituted a new space race and that Europe should join in it; otherwise Europe risked being left behind and becoming a second rate power. Among many other ambitious recommendations, they called for the Galileo program to be accelerated and for negotiations with NATO to decide how PRS should be used and protected.[130]

The year 2007 also saw a significant increase in EU military capabilities. Two 60,000-strong EU Battle Groups[131] became fully operational in January 2007 and were put on-call for contingencies. In February the EU opened the Single Intelligence Assessment Capacity (SIAC) organization which was created by combining the EU General Secretariat's Situation Center with the intelligence division of the EU's military leadership. Its purpose was to provide global intelligence and help in EU security and stabilization operations.[132] Then in June 2007 the EU Operations Center was activated to provide command and control for the EU Battle Groups. Even so, the EU military committee never voiced an opinion on Galileo.[133]

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[129] Christian Cabal and Henri Revol, *Report on the Principal Programmatic Areas of Future Space Policy: Space Policy: Daring or Decline: How to Make Europe World Leader in the Space Domain* (Parliament of France Office for Scientific and Technological Assessment, 2007), 9. http://www.senat.fr/opecst/rapport/rapport_politique_spatiale_anglais.pdf (accessed May 20, 2008)
[130] Cabal and Revol, "Space Policy: Daring or Decline," 4.
[131] The EU Rapid Reaction Force had been restructured and renamed EU Battle Groups.
[132] "EU Building Up Intelligence, Security Capabilities," Paris Intelligence Online, February 23, 2007. http://www.indigo-net.com (accessed August 5, 2007).
[133] Alain Chappe, CNES Head of Brussels office, interviewed by author, December 5, 2007.

Meanwhile, Galileo negotiations remained stalled in early 2007 and Galileo faced its most serious crisis.[134] The eight consortium members could not even agree on the selection of a director for the consortium.[135] A major sticking point developed when Spain demanded that a full control center be located in Spain in addition to the two control centers already planned for Germany and Italy. Germany was Galileo's largest sponsor and German companies, along with the German Transport Minister, were getting impatient. The German Transport Minister advocated using Germany's turn in the EU Council Presidency to pressure the consortium to reach a solution.

Negotiations stopped. In early April EC Transport Commissioner Barrot strongly rebuked the eight companies of the consortium for dithering. He gave them until 10 May to incorporate the company, choose a headquarters, establish a management structure, name a chief executive, and provide a negotiating schedule which would make agreement achievable by September 2007.[136] Otherwise "alternatives solutions" would be presented. Apparently the changes in the context surrounding the Galileo program contributed to the loss of patience among European decision-makers.

On 25 April 2007 the EC person responsible for European Space Policy, EC Vice President Gunter Verheugen, said that in his opinion the Galileo project should be restructured into a more conventional arrangement in which the deployment of Galileo was fully public funded and the concessionaire's responsibility was limited to system operations. ESA Director General Dordain agreed that shifting the full cost of the

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[134] Pierre Sparaco, "European Blockage: Economic Nationalism Impeding Galileo Program," *Aviation Week & Space Technology*," 166, no. 17 (April 30, 2007): 60. http://proxygw.wrlc.org/login?url=http://proquest.umi.com.proxygw.wrlc.org/pq dweb?did=1274625571&sid=1&Fmt=3&clientId=31812&RQT=309&VName=PQD. (accessed January 8, 2008).
[135] "Will European Disagreements Leave Galileo Grounded?" *Spiegel Online.*
[136] Taverna, "United We Stand."

Deployment phase would be ideal.[137] These sentiments were expressed in conjunction with the release of the first ever European Space Policy on 27 April 2007.[138]

The first European Space Policy brought together EU, ESA, and Member State space interests under a single policy framework and provided a concrete political basis for EC leadership in the European space sector. The European Space Policy stated, "Europe needs an effective space policy to *enable* it to exert global leadership in select areas in accordance with European interests and values." In addition, it stated that "Space can contribute to European cohesion and identity." [139] Moreover EC Vice President Verheugen stated in its preface that "Without the European Space Policy Europe could become irrelevant."[140] He pointed out that rising competition from China and India meant Europe could not be complacent. He also made the point that the strategic value of Galileo was undisputable.

The policy stated that Europe was committed to Galileo and that it was essential that it be deployed without further delay. In addition, one of the policy's prime objectives was to ensure sustainable financing for European space applications, including Galileo. In fact, Galileo was a pillar of the emerging European Space Policy and signified Europe's ambitions in space, technology, and innovation. Moreover, in addition to its strategic importance and its contribution to the Lisbon strategy, it "***incarnated*** the political, economic, and technological dimensions of the European Union."[141] [Emphasis added].

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[137] Taverna, "United We Stand."
[138] Commission of the European Communities. *Communication from the Commission to the Council and the European Parliament*: *European Space Policy*, COM (2007) 212 (Brussels: EC, April 26, 2007).
[139] Ibid., 4.
[140] Ibid., preface.
[141] Commission, *Galileo at a Cross-Road*, COM (2007) 261 final, 6.

Another objective of the European Space Policy was to increase the synergy between civil, civil defense, and military space requirements by drawing upon multi-use technologies. In fact the policy creates a link between the ESDP and European Space Policy.[142] Moreover, it states forthrightly that Galileo may have military users. However it also clearly states that military capability will remain within the remit of Member States, ensuring that all action taken would be acceptable in terms of national sovereignty.[143]

In addition, the key 22 May 2007 European Space Council[144] Resolution which approved the EC European Space Policy noted that a structure for dialogue between the EU pillars, Member States, and EDA needed to be set up in order to optimize coordination between civilian and defense programs and users.[145] The joint EC/ESA resolution was unanimously approved by the combined 29 Member States, and gave the European Space Policy substantial politically legitimacy. EC Vice President Verheugen remarked, "Today we have reaffirmed Europe's position as a global space power. Europe possesses some splendid technology and scientific capacities as measured against anyone in the world." Evidently, prestige was an important consideration in the decision to approve the European Space Policy.

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[142] Marcel Dickow, "Security and Defense In the European Space Policy," European Space Policy Institute Flash Report, no. 2 (June 2007). http://www.espi.or.at (accessed August 15, 2007).
[143] Cordis, "Commission Sets Out First Ever European Space Policy," April 27, 2007. http://cordis.europa.eu/search/index.cfm?fuseaction=news.document&N_LANG=EN&N_RCN=27581&q=F7F85EC6AAEEB6E88C43427DC3DF120A&type=hom (accessed August 3, 2007).
[144] The European Space Council was established in 2004 by the 2003 EC/ESA Framework Agreement. It established regular joint and concomitant meetings of the EU and ESA and ministerial level. Its purpose was to provide overall direction to European cooperative space activities. EU Ministers responsible for internal market, industry, and research represent EU interests. Ministers in charge of space activities in the Member States of ESA (usually Research ministers) represent ESA interests. Notice that EU Transport Minister, responsible for Galileo, are not included on the European Space Council, once again underlining the problem of organizational fragmentation in Europe's space efforts.
[145] European Council, "4th Space Council Resolution on the European Space Policy," Press Release 9671/07 (Presse 108), May 22, 2007.

Meanwhile, the Galileo crisis continued. The merged consortium failed to meet the 10 May deadline established by EU Transport Commissioner Barrot to get its house in order. The lack of progress had become a source of embarrassment for the EU.[146] The German Transport Minister Wolfgang Tiefensee said that negotiations had reached a dead-end and agreed that an alternative solution was needed. However, scrapping Galileo altogether was not an option. Giovanni Gasparini, a space expert at the Instituto Affari Internazionali in Rome, pointed out that too much money had already been spent and said that giving up "would be immensely damaging politically for the EU."[147] In addition, Galileo was supposed to be a symbol of technological cooperation and showcase Europe's technological prowess. Moreover, as Michael Praet, Head of ESA's Brussels office, stated "If you don't have space in your tool basket, you will be relegated to the second tier in global competition: in military, economic, and research terms."[148]

The EC adopted the Communication "Galileo at a Cross-Road" on 16 May 2007. It noted that the Galileo project was five years behind its initial schedule and stated that the lack of progress in concession negotiations threatened the Galileo program's survival. This state of affairs could no longer be tolerated. It also stated that the EU had underestimated the technical complexity of the project; the current industrial organization was not efficient or capable of reaching decisions; that the allocation of risk could not be resolved; and the public governance of the project was insufficiently strong and clear. Furthermore it stressed Galileo's symbolic political, economic, and technological

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[146] "Ministers Agreed on Galileo Funds," BBC News, June 8, 2007. http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/6734507.stm (accessed January 15, 2008).
[147] Judy Dempsey, "Funding Breakdown Throws Galileo Satellite Project Off Course," *International Herald Tribune*, May 9, 2007.
[148] Thomas Zehetner and Stephen Pullinger, "Parliamentary Update: June 2007," *European Security Review*, July 2007, 3. http://www.isis-europe.org/pdf/2007_artrel_16_epupdate-june07.pdf (accessed August 12, 2007).

importance and noted that failure to build Galileo would quickly make Europe the only major economy without such a strategic asset.

The EC recommended that the public sector should finance Galileo's Deployment Phase completely and estimated that an additional 2.4 billion euros in public funds were needed. The EC was exploring the possibility of getting the additional funds from either the EC budget or from Member States. The skeptics who had predicted back in 2002 that Galileo's Deployment Phase would necessitate full public funding were right.

The Commission also recommended that ESA act as the procurement agent and designing authority on behalf of the EU. However, it also stated that ESA would have to subject itself to EU procurement rules (no *juste retour*) and be subject to overall EU management of the program. It also argued that although Galileo would remain a civil system, significant revenues might come from military users of the PRS.

Some observers suggested that full government funding of Galileo's deployment only made sense in the context of European military interests, in the context of infrastructure security, and in the context of Europe as independent of GPS and the United States.[149] Otherwise, since the business case had collapsed, Europe could just rely on GPS for free. The fact that the United States, Russia and China used the military to finance and build their respective satellite navigation systems gave this point of view some credence. However Michael Praet, Head of ESA's Brussels' office pointed out that "Space technology is neither military nor civil by definition – it is politics, not technology that decides the way it is used."[150]

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[149] Lewis Page, "Galileo is Military," *The Register*, May 17, 2007. http://theregister.co.uk/2007/05/17gallileo_is_military/ (accessed April 3, 2008).
[150] Zehetner and Pullinger, "Parliamentary update, 3.

On 8 June 2007 the EU Transport Council met and basically agreed with the findings of the "Galileo at a Cross-Road" communication. German Transport Minister Tiefensee, who chaired the meeting, said that Galileo was of "colossal importance" to Europe and added, "We must prove our worth in this field of technology in competition with the United States, Russia, and Asia."[151] Apparently European prestige was also an important factor in this European decision-maker's mind. The EU Transport Council asked the EC to provide more information before the September EU Transport Council meeting. Specifically, it asked where the additional money might be found and what the public sector's procurement strategy, implementation strategy, and management structures would entail.

Just days later the United Kingdom and the Netherlands issued a confidential joint statement to the EU Transport Council rejecting public financing of the project.[152] They argued that the risks to the EU budget were too high and that the best approach was to keep the project as a PPP, including for the Deployment Phase. In addition, some British Conservatives considered Galileo to be nothing but a European "vanity" project.[153] Nevertheless, the United Kingdom's only real choice was to pull out of the Galileo project, in which case the project would go ahead anyway. The EU Transport Council's qualified majority voting rules meant the United Kingdom ultimately could not stop the project without support from more countries.

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[151] "Ministers agreed on Galileo funds," BBC News, June 8, 2007. http://news.bbc.co.uk/go/pr/fr/-/2/hi/scinece/nature/6734507.stm

[152] *Spiegel* reported that the *Handelsblatt*, a German finance magazine, obtained a copy of the confidential statement. "UK and Netherlands Against Public Funding for Galileo," *Spiegel Online*, June 11, 2007. http://spiegel.de/international/europe0,1518,487826,00.html (accessed January 24, 2008).

[153] Taylor Dinerman, "Galileo and Her Majesty's Taxpayers," *The Space Review* (July 9, 2007). http://www.the spacereview.com/article/904/1. (accessed August 7, 2007).

In contrast, a Eurobarometer public opinion poll of 26,000 EU citizens released on 5 June 2007 showed that Europeans were highly positive about the Galileo program. The poll showed that most Europeans were aware of the role global positioning systems played in their everyday lives and an overwhelming majority, 80 percent, thought Europe should have an independent system. In addition 63 percent thought additional public funding was justified and a slight majority agreed that abandonment or significant delay of the Galileo project would harm the image of the European Union (44 percent considered it harmful while 41 percent did not.)[154] Apparently the European decision-makers that supported full public funding for Galileo's deployment had public opinion on their side.

The European Parliament also favored full public funding for Galileo's Deployment Phase. Moreover, the European Parliament stated in its 20 June 2007 resolution that Member States should not be asked to contribute funds directly. Rather, the European Parliament agreed that the funds should come entirely from within the current EU budget.[155] The European Council also reaffirmed the value of Galileo as a key project of the European Union and asked the Transport Council to make a decision on Galileo's implementation by the autumn of 2007.[156]

Meanwhile, in July 2007, European leaders agreed to negotiate a *Reform Treaty* to replace the failed *Constitutional Treaty for Europe*. The *Reform Treaty* again

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[154] European Commission, "Eurobarometer on Galileo: Europeans Support EU Setting up its Own Navigation System," Press Release (IP/07/764) (Brussels, June 5, 2007). http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/764http://ec.europa.eu/dgs/energy_transport/galileoindex_en.htm (accessed August 15, 2007). The full Eurobarometer report is at http://ec.europa.eu/dgs/energy_transport/galileo/index_en.htm.
[155] Cordis, "EU Alone Should Fund Galileo Say MEPs" June 22, 2007. http://cordis.europa.eu/search/index.cfm?fuseaction=news.document&N_LANG=EN&N_RCN=27903&q=F7F85EC6AAEEB6E88C43427DC3DF120A&type=hom (accessed August 3, 2007).
[156] Council of the European Union, *European Summit*, 11177/1/07 Rev.1, (Brussels: EU, June 21-22, 2007), paragraph 36.

designated “space” as a shared competency between the EU and Member States, authorized the European Space Policy, the establishment of a European Space Program, and the establishment of appropriate relations with ESA.[157] It thereby institutionalized space at the very top political level of Europe, placed European space policy firmly within the auspices of the EU, and positioned European space policy to support EU economic and security policies. The *Reform Treaty's* final text was approved in Lisbon in October and it became known as the *Lisbon Treaty*. It was signed by the EU Member States in December 2007 and is going through the ratification process at the time of this writing.[158]

By September 2007 the relevance of the new European Space Policy and the draft *Reform Treaty* were put to the test when the issue of Galileo's organization and public funding was considered in more detail by the European Transport Ministers. European decision-makers were aware that failure to agree on how to proceed with Galileo would undermine the new European Space Policy.[159] In its 19 September 2007 Communication to the European Parliament and the Council that preceded the Transport Council meeting, the Commission stressed the urgent need and strategic implications of a decision and emphasized Galileo's “vital security and economic functions.” This was the first time in an official communication that Galileo's security functions took priority order over its economic importance and civil uses. The EC Communication went on to state

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[157] Presidency of the Intergovernmental Conference, *Draft Treaty Amending The Treaty on the European Union and the Treaty Establishing the European Community*, CIG 1/07, presented to the Conference of the Representatives of the Governments of the Member States, (Brussels: July 23, 2007), 46 and 88.
[158] It is beyond the scope of this study to discuss the status of the treaty ratification process. However, just before this study was completed the *Lisbon Treaty* was rejected in a referendum by Irish voters. The status of the treaty remained in limbo as this study was completed.
[159] Patrick Rudloff, EADS Head, Brussel Office, interviewed by author, Brussels, BE, December 5, 2007.

"Moreover, Galileo is a pillar of the European Space Policy and signifies Europe's ambitions in space, technology and innovation."[160]

The Communication proposed a new governance structure for the Galileo program. The EU Transport Council and the European Parliament would remain fully responsible for political and program oversight. The EC Transport Directorate General would act as the sponsor and program manager. ESA would serve as the prime contractor with responsibility for the four in-orbit validation spacecraft, the 26 operational spacecraft, and the ground segment. The GSA was given responsibility for marketing services, handling licensing and certification, and advising the EC.

The Communication's main contribution however, was its proposal to use 1.7 billion euros in 2007 and 500 million euros in 2008 from unused farm subsidies to pay for Galileo. In addition, the remaining 200 million euro shortfall would come from unspent funds for running EU institutions.[161] This proposal meant that the 2007-2013 EU Financial Perspective which had been arduously negotiated for many years among the EU Member States, would not have to be reopened.

France, Italy, and Spain welcomed the proposal, although France and Spain had reservations about tapping the unspent agriculture funds. Likewise, the United Kingdom and the Netherlands now backed the use of EU funds but were uneasy about reallocating money within the EU budget. However, the proposal received a cold reception by Germany. Distribution of gains issues had not been addressed in the EC's proposal. Germany insisted that Galileo should be implemented as an ESA "optional" program.

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[160] Commission of the European Communities, *Communication from the Commission to the European Parliament and Council: Progressing Galileo: Re-Profiling the European GNSS Programmes*, COM (2007) 534 final (Brussels, EC, September 19, 2007), 2.
[161] Ibid., 9. Also, "EU Plan for Funding Galileo Satnav System Already Hitting Snags," *Agence France-Presse*, September 25, 2007.

Since Germany provided the Galileo project the most money, indirectly through the EU budget and directly through ESA, Germany wanted its space industry to benefit in proportion to Germany's contributions.[162] Germany also strongly opposed the idea of re-allocating unspent farm subsidies (which usually were refunded to EU Member States), arguing that such a step was a dangerous precedent.

Then, as if attempting to put a nail in the Galileo coffin, the United States. announced that GPS III would not feature the Selective Availability capability. This meant that GPS's most precise signals would be globally available, for free, without the United States having the capability to degrade the signal except through local jamming techniques. Galileo's business case, including its case for PRS, was in tatters. There is no evidence that this decision was linked to any type of American strategic opposition to Galileo. However, it served as an important reminder that commercial competition between GPS and Galileo continued.

The EU Transport Council made no decision in its meeting of 1-2 October 2007 and simply stated its intention to make a decision before the end of 2007.[163] Soon thereafter, the EC Transport Commissioner Barrot said that if agreement was not reached by the end of 2007, the Galileo program could be abandoned.

On 23 November 2007 EU Finance Ministers and the European Parliament agreed that funding for Galileo's Deployment Phase would come two-thirds from the 2007 unspent farm subsidies. The remaining one-third would come from two sources: unspent 2008 Seventh Research Framework Program (FP7) transport-related funds, and unspent

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[162] *Agence France-Presse, "EU plan for funding Galileo Satnav System Already Hitting Snags," AFP, Paris, September 25, 2007*. "Paymaster for 'Galileo' Wanted," *Der Spiegel*, November 5, 2007.
[163] Council of the European Union, *Council Conclusions on the European Galileo and EGNOS Satellite-Navigation Programmes*, Press Release, October 2, 2007.

funds for running EU institutions.[164] The big breakthrough came when both the United Kingdom and the Netherlands unexpectedly dropped their objections. The reasons for this turnaround are unclear.[165]

The EU Transport Council met again on 29 November 2007 to make final decisions on Galileo's new governance and spending. If agreement could be reached, the Galileo program would enter into the Deployment Phase, with Galileo becoming fully operational by 2012. The main issue was how to distribute the 3.4 billion euros in contracts to deploy Galileo. Germany had grave doubts. However, Germany gave approval to the new financing plan when it became clear that Germany would play a lead role through EADS Astrium, which would most likely win contracts to build many of the 26 Galileo satellites remaining to be built. In addition, the German SAR-Lupe satellite manufacturer, OHB Systems, made an agreement to team with the U.K.-based Surrey Satellite Technology Ltd in order to compete against EADS Astrium and (presumably) Thales Alenia for contracts to build Galileo satellites.[166] Of course, Germany also was to get one of the two Galileo control centers and DLR was selected to operate the four IOV satellites. Ultimately, it was agreed that the Galileo project would be cut into six

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[164] Agence France-Presse, "EU Nations 'Close' to Political Agreement on Satnav Project,"AFP, November 29, 2007. Michael A. Taverna, "New Scheme for Galileo and Egnos," *Aviation Week and Space Technology* 167, no. 12 (September 24, 2007): 36.
Council of the European Union, "2833rd Council Meeting: Economic and Financial Affairs: Budget," Press Release, 15231/07 (Presse 260) Brussels, November 23, 2007, 10. The precise financial breakdown is as follows: 1.6 billion euros from 2007 unspent farm subsidies; 400 million euros from FP7 transport related research activities. 200 million euros from: "Standardization and approximation of legislation" – 28 million; Euratom – 50 million; "Procedures for awarding and advertising public supply, works and service contracts" – 46 million; "Pan-European eGovernment services to public administrations, enterprises and citizens (IDABC);" – 15.9 million; Conference Interpreter Training for Europe (CITE);" "Decentralized Agencies (linear cut) – 50 million. Total 2.5 billion euros.
Agence France-Presse, "Diplomat says EU Reach "General Agreement" on Galileo SatNav Project," *AFP*, November 29, 2007.
[165] Michael A. Taverna, "New Deal; SSTL, OHB Systems Agree to Team on Galileo," *Aviation Week & Space Technology* 167, no. 22 (December 3, 2007): 49. I was not able to determine what caused the United Kingdom and the Netherlands to change their positions.
[166] Ibid.

segments, including constructing the satellites and launchers, the ground network, and project management. No single company could be prime contractor for more than two segments. By this means the contracts would be spread across the European space industry and across Europe geographically.

Unexpectedly, Spain now demanded a larger share in the Galileo project and insisted on hosting "part" of a control center.[167] Italy perceived this as a threat to the control center that it was to host. The unexpected move by Spain astonished other transport ministers.[168] However, in a rare and surprising move which indicated the significance of Galileo, the EU Transport Council did not engage in extensive bargaining in order to strike consensus and arrive at the usual, more politically acceptable, unanimous decision. Instead, using qualified majority rules the Transport Council voted to approve the new plan, much to Spain's chagrin. The next day Spain changed its vote and the EU Transport Council's decision became unanimous.

The final word in this Galileo chronology goes to the European Commission's December 3, 2007 information note, "Political go-ahead for Galileo." This brief note discussed the final conclusions of the November Transport Council meeting in somewhat of a worn out yet contented tone. It concludes by saying:

> Although early in the year there was considerable doubts with regard to Galileo, there is now broad public and political support for the programme. As evidenced by the press reactions around the world, the European Union is seen to be able to decide on truly strategic, high technology projects.[169]

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[167] Jeff Mason, "EU Haggles over Satellite Navigation Project," *Reuters*, November 29, 2007. http://www.reuters.com/articlePrint?articleId=USL2937381020071129 (accessed November 29, 2007).
[168] Agence France Presse, "Spain Rejects EU Agreement on Galileo Satnav Project," *AFP*, November 30, 2007.
[169] EC, "Political Go-ahead for Galileo." December 3, 2007. http://ec.europa.eu/dgs/energy_transport/galileo/documents/doc/2007_12_03_council_results_en.pdf

2. Findings:

Chapter Seven traced the complex events from the start of the Development Phase in March 2002 to the 2007 EU decision to drop Galileo's PPP funding and management structure and to fund Galileo's Deployment Phase 100 percent with money from the EU budget.

Although the evidence is not completely clear or consistent, this study found that realist factors weighed heavily on European decision-makers' minds and were probably the relatively most important factor in the decision for Galileo to go forward. A weakened United States, a resurgent Russia, and a rising China insured that European decision makers' assessments of the need for Galileo were heavily influenced by realist factors. Also, for the first time in this study, there is sufficient evidence to argue that ideational factors also weighed heavily. China and India's rapidly improving space capabilities made Europe's ability to follow through on Galileo a matter of European pride and prestige within Europe and at the international level. The credibility of the EU as an institution able to efficiently meet the collective needs of its Member States was also at stake. Nevertheless, there is also considerable evidence that liberal factors were still very significant. However, liberal factors declined in influence as the business case for Galileo steadily eroded, international cooperation was scaled back, and the international environment changed.

Hypothesis A: Realist factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.

I do **not** reject Hypothesis A due to several indicators that realist factors weighed heavily on European decision-makers' assessments of the need for Galileo.

Organizationally, the Galileo program ended the Development Phase under the control of the EC. With the dissolution of the GJU and the collapse of the PPP management and financial structures, the private sector was no longer involved in Galileo program management.

The EC is not by nature a security or defense organization. But during the timeframe covered in this chapter, the EC took on an overt security role (in the broadest sense of security) and the barriers between the first and second pillars of the European Union began to erode. A careful reading of the 2003 the EC/ESA White Paper on space shows that the security and defense aspects of Galileo were an important consideration with regard to Europe's space ambitions. In 2004, the creation of the EDA provided an important nexus between the first and second pillars. In 2006 the EC funded the ASTRO+ out-of-area security exercise through its "Preparatory Action for Security Research" budget.[170] This exercise demonstrated militarily useful space capabilities - including the use of EGNOS to simulate Galileo. The 2007 European Space Policy also created a link between the pillars and stated that Galileo was available for military use, due to its multi-use nature, despite the fact that the Galileo system would be managed and operated by civil authorities. It also linked the European Space Policy to broader EU goals and objectives including those coming within the purview of the CSFP and the ESDP. The European Space Council also advocated stronger links between pillars in its May 2007 resolution affirming the European Space Policy. Finally, the failed

[170] The Preparatory Action for Security Research budget was part of the Sixth Research Framework Program (FP6).

Constitutional Treaty and the currently being ratified *Lisbon Treaty* also removed barriers between the two pillars. Although these documents have not come into force, they demonstrated the intent of key European decision-makers to dilute the distinction between the pillars. So even though the EC is not currently considered to have competency as a military or defense actor, that distinction weakened during this period.

ESA is the other key organization to consider. During the period covered in this chapter, the taboo against ESA involvement in security-related projects vanished.[171] The ESA Director General's willingness to adopt the interpretation of the ESA convention to meet the EC's security space requirements (and Member States raising no objections) indicates that realist factors at the European-level were significant. In addition, through the 2003 EC/ESA *White Paper on Space*, the 2003 EC/ESA *Framework Agreement*, the 2007 *European Space Policy*, and the 2007 *Reform Treaty*, ESA became the EU's technical advisor and supplier of space capabilities, including capabilities needed to support the ESDP. In fact, in 2007 ESA was even given the lead on researching a Space Situational Awareness (SSA) capability for the EU, which has considerable strategic security and defense implications.[172] ESA now has a SSA project team in ESA's Office for Security Strategy and Partnership development.[173] Moreover, it is foreseen that eventually ESA will be the EU's space agency.

[171] The change in the interpretation of "peaceful purposes" in ESA's charter caused some minor grumbling and disillusionment among the ESA staff when it first came about. Frederick Nordland, Head ESA Washington D.C. office, interviewed by author, Paris, June 2004. However, by September 2007 it was not an issue or concern among ESA staff. Naja and de Cooker, interviewed by author, Paris, France, September 17, 2007.

[172] It is beyond the scope of this report to delve into the details of the EU/ESA SSA initiative.

[173] "ESA Approves Space Situational Awareness Program," *C4ISR Journal: The Magazine of Net-Centric Warfare*, July 1, 2008. http://www.c4isrjournal.com/story.php?F=3549124, (accessed July 14, 2008).

The GSA is also a civil organization, but as noted in Chapter Two it retains responsibility for Galileo's security and therefore has a link to European military authorities.

In sum, organizationally the Galileo program is still a civil program under civil control. However, the civil organizations in control of the program have evolved into organizations which connect more and more to the defense and military realms.

The nature of the sources of money for the Galileo program also changed during this period. Throughout most of the Development Phase the plan was for two-thirds of the funding for Galileo's deployment to come from private sources. The plan was for 100 percent of the funding for the Operational Phase to come from private sources. As we know, however, at the end of 2007 the EC decided to finance Galileo's deployment 100 percent from public funds. (The organizational and financing arrangements for the Operational Phase, scheduled to start in 2012, remain undetermined). Although none of these funds came from military or defense budgets, the fact that key decision-makers decided to raid civilian agricultural and research funds (and not refund those funds to Member States) for a strategic multi-use system with clear military uses indicates the priority given to the Galileo program.

In sum, the Galileo program is now to be funded for at least the next several years totally through European level public sources. Private financing failed and defense funds have never been involved. Nevertheless, the reduction in the organizational barriers between the first and second pillars of the EU indicates that although the EU funding came from the EC side of the house, that does not preclude the second pillar from benefiting from it.

In addition, the sudden decline in importance of international cooperation in the Galileo program in 2006 and 2007 indicates the growing strength of realist factors. Until then, international cooperation for liberal reasons had been a key aspect of the Galileo program. Recall from Chapter Four that since the 1960s with the Aerosat program, Europe had always considered its civil navigation satellite program to be an opportunity for international cooperation. Recall that a significant aspect of European space strategy since the 1960s was to engage in cooperative efforts in order to spread the costs and make it possible for Europe to benefit from space activities it would otherwise not be able to afford. Also bear in mind that the 1990s commercialization of space and consolidation of the space industry included the rise of international strategic commercial partnerships.

Until late in the Development Phase, EC Galileo-related official communications consistently expressed the desire for the Galileo program to involve international cooperation with not only the United States but also with Russia and other states as well. The February 1999, EC Communication “Galileo” discussed at length cooperation with the United States, Russia,[174] and Japan. Furthermore, it stated that contact had been made with several “other counties” including: Australia, Canada, China, Iceland, India, Korea, Turkey, Switzerland, as well as countries of the CIS, Africa, and South America.[175] The 1999 EC “Galileo” communication also stated “the nature of this [other county] cooperation is unlikely to reduce significantly the cost of building Galileo but could contribute to global interoperability and potential market opportunities and revenue

[174] It was later decided that compatibility and interoperability with Russia’s Glonass system was not desirable for two reasons. First, the Russians were unlikely to complete the modernization and launch of the Glonass constellation in a timely manner. As of 2002, only seven Glonass Satellites were in service. Second, the Glonass frequency spectrum and signal structure made it difficult and therefore costly to make user applications compatible and interoperable. Lindstom and Gasparini, “The Galileo Satellite System,” 23.

[175] EC “Galileo” February 10, 1999, 7.

streams."[176] When viewed with this background in mind, it appears reasonable to argue that liberal factors were the primary motive for the EU to seek international cooperation in the Galileo program up until 2006 - 2007.

Nevertheless, the 2003 agreement to cooperate with China could be interpreted differently – especially with regard to balancing the United States. The February 2004 EC Galileo progress report to the Council and the European Parliament positively gloats about the EC's success in negotiating this "exemplary" agreement with China and attracting other counties' interest in cooperating in the Galileo program. It states, "Third countries coming forward in ever-increasing numbers asking to be associated with the project have definitely got their priorities right."[177] Also, in addition to stating the technical and economic reasons which made cooperation useful, it emphasized the *political* benefits of cooperation numerous times and states lastly, "International cooperation involves a strong political dimension, since it enables numerous third countries to be associated with the management of a strategic infrastructure."[178] A nuanced reading of such sentiments may indicate that realist factors (with regard to balancing the United States) were a consideration in the decision to cooperate with China.

However, complicating the picture again, the same EC communication acknowledged that making Galileo and GPS compatible and interoperable had been a priority for four years. It stated that the objective was to gain interoperability for the benefit of users. This reflected the importance the EC attached to efficiency and mutual gains. So even within the same EC communication, and within the same section on

[176] Ibid.
[177] Commission, *Progress Report,* COM (2004) 112 final, 9.
[178] Ibid., 8.

international cooperation, it is possible to perceive the influence of realist factors and liberal factors simultaneously.

In addition, as noted earlier, the transport ministers were organizationally, bureaucratically, and culturally more inclined toward maximizing Galileo's economic usefulness and in minimizing its cost to the taxpayer. The events of the 2000 – March 2002 Definition Phase during which the transport ministers could not agree to launch the Development Phase, due to doubts about the feasibility of private financing for Galileo, showed that they were not thinking about balancing the United States (until pressured to do so, as discussed in Chapter Five). Once they made the decision in March 2002 to enter the Development Phase, the political pressure eased and it is reasonable to assume that they went back to focusing on finding ways to finance Galileo without dipping into the public purse. Cooperation with China and other countries was an attractive means to that end. It is also perhaps a bit unconvincing to argue that they were also thinking about balancing American power, while simultaneously working to make Galileo and GPS compatible and interoperable for their mutual benefit.

Likewise, as discussed above, European research ministers who oversaw ESA were more interested in the distribution of gains to ESA Member States than on balancing the United States. In fact, ESA was upset that the EC had negotiated the cooperation agreement with China.[179] ESA was never consulted. Likewise, there is no evidence that any European defense or military authorities had a say in the EC's Galileo negotiations with China. The prospect of Chinese firms taking away potential contracts from European firms was also disconcerting to the European space industry.[180]

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[179] Author's observation based upon interviews of ESA officials in 2004 and 2007.
[180] Author's observation based upon interviews of EADS and Eurospace officials in 2004 and 2007.

Therefore, it is reasonable to argue that given Europe's long history of seeking international cooperation in space projects for liberal reasons, liberal factors carried the most influence in European transport ministers' assessment of the desire for cooperation with China, the United States, and other countries through 2005. Such cooperation made political, economic, and technical sense from a liberal perspective.

However, after a flurry of agreements being initialed in 2005, the June 2006 EC Communication "Taking Stock of the Galileo Programme" merely states that international cooperation is "essential," presents a laundry list of agreements and on-going negotiations,[181] and states that the emphasis is on "taking account of obligations connected with intellectual property and protection of dual-use technology."[182]

It was around this time that EU decision-makers became concerned about the military and economic implications of China's "Compass" or "Beidou" navigation satellite system. The transition from the GJU to the GSA at the end of 2006 provided a convenient excuse for the EU to drop cooperative agreements with China and many other non-European countries.[183] It is reasonable to argue that this was done due to the realist oriented perspective that China and other countries might gain technologically from Galileo and use that gain against Europe. Apparently the risk of international cooperation with some countries now outweighed the benefits.

Nevertheless, the drop in the emphasis on international cooperation may also be due to the fact that the EU was focused on the deadlock in concession negotiations and

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[181] To recap, cooperation agreements were signed with China on 30 October 2003 and with Israel on 13 July 2004. Similar agreements were initialed with Ukraine on 3 June 2005, with India on 7 September 2005, with Morocco on 8 November 2005 and with South Korea on 12 January 2006. In mid-2006 further agreements were being drawn up with Norway and Argentina and discussions were under way with Switzerland, Canada, Australia, Saudi Arabia and Brazil. Commission, *Taking Stock*, COM (2006) 272 final, 9.
[182] Commission, *Taking Stock*, COM (2006) 272 final, 9.
[183] Giulio Barbolani di Montanto, ESA, interviewed by author, Brussels, BE, December 7, 2007.

was preoccupied with the Galileo's program's survival. But this argument ignores the changes in the international context surrounding the EU and the Galileo program. European leaders were shocked by the Chinese ASAT test in January 2007 and alarmed by Russian threats to European energy supplies.[184] It is reasonable to assume that these strategic level events influenced European leaders' perception of the security threats to Europe. Naturally, such a perception means that realist factors became more significant. It is perhaps no coincidence that German concerns about the military uses of Galileo were sidelined and British objections became more muted.

Finally, a slew of reports, studies, statements and other expressions of policy indicate that realist considerations were becoming more relevant to European space activities and to Europe in general during the first years of the 21st century. First, the growth of the ESDP, the adoption of a European Security Strategy, the establishment of EU Battle Groups, the EDA, and the overall growth of EU military capabilities indicate that realist factors weighed heavily on European decision-makers' minds. Since space capabilities enable most modern defense systems, they became an important factor in the development of EU military capabilities.

Next, many documents and statements demonstrate the growing importance of military space capabilities to the EU including the top-level, July 2002 EC *Strategic Aerospace Review for the 21st Century (STAR 21)* report, the 2003 ESA report *Space and Security in Europe*, the 2003 EC/ESA *White Paper on Space*, the 2004 European Council *ESDP and Space*, and the EU March 2005 *Report of the Panel of Experts on Space and Security*. In addition, the EU recognized that it would pay an increasingly high price if the dual-use capabilities of space assets were kept artificially separated. Luc Tytgat, at

[184] Bernard Molard, interviewed by author, Paris, FR, September 20, 2007.

the time the Head of the EC Space Policy Unit, said that space would become "inter-pillar."[185] Likewise, the *European Space Policy* linked Pillar One and Pillar Two and acknowledged that Galileo might be used for military purposes.

Finally, as outlined in the narrative above, many European decision-makers made statements that Galileo would have military uses.

In sum, there is sufficient evidence to conclude that realist factors most likely weighed the most heavily on European decision-makers' assessments of the need for Galileo at the end of 2007. The heavy influence of realist factors provided the rationale to finance Galileo's deployment completely with public funds and helped the Galileo program survive.

Hypotheses B: Liberal Factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.

I reject Hypothesis B for the reasons stated in the section above. In short, the collapse of the PPP, the rising cost to the taxpayer, and the steep decline in international cooperation indicate that the profit, efficiency, and cooperation motives for the program had weakened significantly. If such liberal motives mattered the most, it is doubtful that the Galileo program would have survived past 2007.

However, there a many indicators that liberal factors still carried significant weight. Galileo's funding still came from civil sources and it was still planned, managed, and controlled by civilian authorities – (although these indicators are less significant for

[185] Luc Tytgat, Former Head of EC Space Policy Office, interviewed by author, Brussels, Belgium, June 2004.

the reasons outlined above). The plan still foresaw some type (to be determined) of private control of the Operational Phase, and fees for services were still part of the plan.

Nevertheless, there is sufficient evidence to conclude that liberal factors did not weigh the most heavily on European decision-makers' assessments of the need for Galileo. Liberal factors were most likely significant intervening variables which contributed to decision-makers' assessments.

Hypotheses C: Ideational Factors weighed the most heavily on European decision-makers' assessments of the need for Galileo.

I reject Hypotheses C although a flurry of official expressions of policy highlighted the importance of Galileo for the EU's international image and identity. These statements were given extra weight because both the EC and ESA are supposed to strictly follow the mandate to get best value for the money in their programs. Therefore, emphasizing the prestige a project engenders, or highlighting the cohesiveness a project might inspire, risks being politically and fiscally counterproductive for the EC and ESA. The United Kingdom was especially against space "prestige" projects. Germany's position was similar. Consequently, the EU's relatively sudden stress on the importance of Galileo to European prestige and identity may indicate that Galileo's economic rationales had become relatively less important and ideational factors relatively more important. However, sufficient evidence to make a convincing argument that ideational factors were the most significant factors is lacking.

To recap from the narrative above, statements in documents and by leaders in 2007 indicated that Galileo was an important source of European prestige. For example, the May 2007 EC "Galileo at a Cross-Road" communication said that Galileo incarnated the political, economic, and technological dimensions of the European Union. In addition, the joint EC/ESA European Space Policy stated that "Space can contribute to European cohesion and identity."[186] Moreover, in conjunction with the resolution which approved the EC European Space Policy, EC Vice President Verheugen stated that the decision reaffirmed Europe's position as a global space power and he measured European space capabilities against others in the world. Evidently, prestige was an important consideration in the decision to approve the European Space Policy. Likewise, the last EC official statement on Galileo in 2007 indicated that the world's perception of the EC and the Galileo program mattered to the EC. In addition, the success of China's manned space program and India's growing space capabilities enhanced China and India's prestige while Galileo's glacial progress arguably had diminished the EU's prestige.

The evidence presented above is not sufficient, however, to convincingly argue that ideational factors may have weighed the most heavily on European decision-makers' assessments of the need for Galileo. There were so many important realist and liberal justifications for Galileo that it is unlikely that ideational factors were most important. Therefore, although ideational factors were very important and rose in significance, it is more likely that they were significant intervening variables in the decision to move to full public funding and approve the start of Galileo's Deployment Phase.

[186] Commission, *European Space Policy*, COM (2007) 212, 4.

Levels of Analysis: It is reasonable to argue that national and industrial level competition over the distribution of gains nearly killed the Galileo program during the Development Phase. However, the European Union interests that coalesced at the international level were ultimately able to overcome the roadblocks put in Galileo's way. Therefore, it is reasonable to argue that the international level remained relatively the most influential level.

3. Summary: Chapter Seven traced the complex events from the start of the Development Phase in March 2002 to the 2007 EU decision to drop Galileo's PPP funding and management structure and to fund it 100 percent with money from the EU budget.[187] Although the proof is not definitive, the increasing emphasis on realist factors during the Development Phase contributed significantly to the Galileo program's survival.

[187] Dr. Kevin Madders, a leading scholar on European Space Policy said that "The confusion that reigned in that period is a phenomenon in itself." E-mail interview, June 2007.

Chapter Eight:
The Journey Continues

The purpose of this study was to improve understanding of the Galileo program's ability to survive despite serious obstacles. I found that there was a subtle but noticeable shift over time in the relative weight of the factors influencing European decision-makers. I conclude that it is reasonable to argue that this shift contributed to Galileo's ability to survive.

I arrived at this conclusion by attempting to answer two basic research questions: 1) Did realist factors, liberal factors, or ideational factors weigh the most heavily on European decision-makers' assessments of the need for Galileo? 2) Were European decision-makers' assessments of the need for Galileo being driven more by the international, European, national or industrial levels?

Table 1. Short Definitions of Factors

Factors	Key Aspects
Realist	- Significant presence of defense and/or military motives, actors and resources - State preferences completely dominate international institutions - Preference for material gains and zero sum gains - Emphasis on military security - International alliances motivated by balancing
Liberal	- Significant presence of economic motives, civil and commercial actors, and civil and commercial resources - International institutions have some ability act independently - Preference for efficiency and non-zero sum gains - Emphasis on economic and human security - Emphasis on international cooperation and interdependence
Ideational	- Significant presence of motives generated by actors' norms, values, beliefs and identity. - Emphasis on symbols, ideology, and prestige. - Regard for soft power including consideration of cultural attraction and ideology

Table 2. Levels of Analysis

International level	Considers the EU as "if it" is a rational state actor and focuses on Europe's relationship with the world beyond Europe, particularly the relationship the United States
European level	Considers the interests of European institutions and their interaction with key member states. The European institutions considered are the EC Transportation Directorate General, Pillar Two of the EU, and ESA.
National level	Considers the interests of the key European states involved in the Galileo project, namely France, Germany, Italy and the U.K..
Industrial level	Considers the interests of the prime contractors from the "upstream" portion of the European space industry (satellite manufacturers, launcher manufacturers, and launch service providers).

Recognizing that it is not possible to definitively answer the above questions, this study took a macroscopic view and sought to detect if there has been an identifiable shift over time in the comparative weight of the factors driving Galileo. This study sought to be sensitive to any slight changes of emphasis by closely investigating European decision-makers' assessments of the need for Galileo at key decision points which occurred in 1999, 2002, 2004, and 2007.

Briefly, I found that the Galileo program was initiated in 1999 with liberal factors as comparatively more influential, with realist and ideational factors as significant intervening variables. The primary indicators supporting this finding include: the long time period in which European leaders had been investigating the possibility of a collective European space effort to provide a civil navigation satellite system; the civilian nature of the organizations leading and funding the effort; the lack of significant military or defense interest in the Galileo project or financial contributions to the project; the lack of significant planning for military or defense control of the project or input into the project's design requirements; and the de-emphasis of prestige as a serious rationale for spending huge sums of money on space activities. In addition, the commercial boom in

GPS services and applications made the appeal of a more advanced, civilian, commercially oriented GNSS system specifically designed for profit an appealing vision.

Table 3. Context at Key Decision Points

Decision Point	Context in Which Decisions Were Made:
June 1999: Definition Phase Approval	- Decades long interest in civil Global Navigation Satellite System - Rapid integration of U.S. GPS into all levels of society with corresponding loss of autonomy - Growth of EU international role and EU Interest in Space - Consolidation of aerospace industry, growth of commercial space markets and use of PPP's - Lack of European military interest, investment, or design requirements in Galileo - U.S. resistance to Galileo and the appearance of an effort to undermine it - Kosovo Crisis
March 2002: Development Phase Approved	- Disagreement over primary purpose of Galileo: strategic or for profit - Uncertainty over economic viability of Galileo's business case - Lack of clear organizational structures and responsibilities - Collapse of commercial space market - Member State's focus on maximizing own distribution of gains - Staunch U.S. resistance to Galileo, U.S. unilateralism, and high pressure tactics - European military brass pressure on Transport Ministers
June 2004: Galileo-GPS Agreement	- PRS overlay issue resolved. EU gives up potential leverage on GPS. - GPS and Galileo to be compatible and interoperable
November 2007 Deployment Phase Approved	- Hard bargaining over distribution of gains among Member States - Unsettled questions over the distribution of risk between private and public sectors - Delays cause potential loss of future market to GPS III - Growth of ESDP and EU military capabilities - Collapse of PPP structure - EU image, credibility and prestige threatened

The rise of the commercial space market and the emergence of the PPP as an alternative funding mechanism also provided new tools which European decision-makers could leverage to drive down the public cost and make the system politically feasible. It is reasonable to argue that it is unlikely that a political consensus could have been reached among EU Member States to approve the start of Galileo's Definition Phase in 1999 if realist or ideational factors had been the primary rationales.

However, the Galileo project was nearly derailed in 2001-2002 due to concerns about Galileo's commercial viability and the feasibility of attracting significant private funding. For over a year, the transport ministers from the United Kingdom and Germany refused to give the go ahead for Galileo's Development Phase without assurances about private sector funding. They also refused to consider increased public funding for Galileo and emphasized Galileo's civil uses and commercial prospects rather than its security aspects. The availability of GPS signals without charge and U.S. plans for improvements in GPS's civilian signals made it difficult to continue to justify Galileo in terms of efficiency, cost effectiveness, and commercial advantage.

The project survived because these concerns were set aside when the Transport Council came under pressure from EU Heads of States and Governments and top European military leaders. In the autumn of 2001, realist factors emerged as the relatively more significant consideration as indicated by official expressions of policy, the emergence of the ESDP, increasing European interest in the use of space for military and security purposes, and moves to expand the programs in which ESA could engage to include "non-aggressive" military and security related activities. In addition, the relationship between the United States and its European allies became more frosty, especially after the December 2001 Wolfowitz letter, giving some credence to the argument that Europe wanted to strategically balance the United States, economically, technologically, and militarily to some degree. The Galileo program most likely would not have survived if the emphasis had remained on Galileo's commercial prospects and supposed ability to inexpensively provide a vital public good.

However, the 2004 EU – U.S. agreement on compatibility and interoperability would most likely not have come to fruition if realist factors had dominated European decision-makers' perspectives of the relationship with the United States. If realist factors were relatively the most significant, it would have been unlikely that European decision-makers would have agreed to relocate the PRS signal so that it no longer overlaid the GPS military code. Doing so made it possible for the United States to jam the PRS signal without affecting the GPS military signal and took away the EU's potential future ability to influence United States GPS policy. Instead, the agreement to move the PRS signal and the agreement to make GPS and Galileo open service signals compatible and interoperable demonstrates that liberal factors, such as high regard for efficiency and cooperation, relatively outweighed the other factors at this point in the program's evolution.

Nevertheless, the Galileo project was nearly derailed again in the 2005-2007 timeframe when distribution of gains issues stymied agreement among European research ministers in charge of ESA and the governments they represented. More importantly, questions about Galileo's commercial viability and the risk to private financiers derailed agreement on a PPP management and funding mechanism for the Galileo program. It is reasonable to argue that liberal rationales for the Galileo program lost influence as prospects for Galileo to efficiently provide a public good evaporated and its potential to be used as a tool to improve international cooperation faded away. Galileo most likely would not have survived if liberal rationales such as these were the primary drivers. Instead, the growing influence of realist factors provided the motive for European decision-makers to make the unprecedented decision to provide a massive amount of

public funding by reallocating funds from within the EU budget. The Galileo program was saved by this move.

For these reasons, I conclude that Galileo's ability to survive has been due to a subtle but identifiable shift in the relative weight of the motives which have driven Galileo over the years. However, it is necessary to be mindful that this finding is a subjective judgment – but a judgment based on numerous interviews and a careful reading of primary and secondary written sources.

In addition, it was useful to attempt to separate the levels of analysis even though there is a tight symbiotic relationship among all the levels and it is difficult to separate them. Separating the levels of analysis allowed relationships among the various actors to be examined more systematically and helped to shed light on motives that might have otherwise been missed or misinterpreted. While acknowledging the advantages and risks with such an approach, I make the reasoned judgment that the international level of analysis was likely the most significant level through all four decision points examined.

The motivations coming from the industrial, national, and European levels interacted and were aggregated by the EC along with the EC's own interests and preferences. This interaction led to the development of distinct international level preferences whereby the whole was greater than the sum of the parts.

The international level mattered more than the inwardly focused European level due to the simple fact that Galileo cannot be properly considered outside the context of its relationship to GPS and Europe's collective relationship with the United States. The institutional relationships and interactions between DG TREN, Pillar Two, ESA and member states was important but in many key respects, Galileo was a reaction to GPS.

Naturally, the European space industry, i.e. the industrial level, figured to benefit greatly from the multi-billion euro Galileo program. The prime contractors from the European "upstream" space industry consistently wanted to expand European involvement in space through greater public funding for space activities. Galileo would create demand for a large number of satellites, launch vehicles, and a major operational infrastructure. The resulting greater economy of scale would make the European space sector more competitive globally. In addition, the technological challenge would boost the industry's comparative advantage and make it more competitive in the global commercial space market.

It is difficult to conclude, however, that the industrial level was relatively more important than the other levels at each decision point. The officials I interviewed consistently stated that the Galileo initiative was driven more by official political and economic interests than by industrial lobbying. However, this assertion is difficult to confirm one way or another, since in many ways there is often a symbiotic relationship between industrial, technological and governmental interests.

It is also safe to say that the national level was very important in the Galileo decision, and even possibly the most influential level. The realist perspective, that the European Union's decisions simply reflect the Member States interests, is assumed by many observers in much of the literature on Galileo.

However, it is not difficult to find that the leading states had conflicting preferences which make it unlikely that the national level, by itself, was the most important level. There were many structural and historical differences among each states' space program. The international level was needed to ameliorate the diverse

preferences of the European states and overcome conflicting interests and perspectives. In addition, it is important to be reminded that the scale, complexity, and cost of the Galileo program meant that no single European state could have launched the Galileo program by itself.

Nevertheless, states threw roadblocks in the way and bargained hard for the best deal. However, in 2002 the United Kingdom backed down from its demands once it saw that it did not have enough support from other states to block the start of the Development Phase. Likewise, Spain tried to block approval of the Deployment Phase in 2007 but was outvoted by the rest of the Transport Council member states.

One last indicator makes it reasonable to argue that the international level was more significant than the national level. Simply put, the EC – a supranational organization - manages the Galileo program. EC decisions concerning Galileo are taken using qualified majority voting rules. Consensus among all member states is not required to move the Galileo program forward. If the national level were the most significant, Galileo should either have been structured as a bi/multi-lateral program or structured within a new, functional intergovernmental organization. Other collective European space projects had been structured in such a way in the past, such as EUMETSAT.

Given the above considerations, I judge that the international level was relatively the most significant level throughout the four decision points studied. The national level and industrial level, in turn, were the next most significant levels. The European level was important but the least significant. The existence of many other collaborative European space projects indicates that the pull and haul among the European institutions

involved in the Galileo project were not necessary or sufficient to motivate European decision-makers to authorize Galileo.

To arrive at these conclusions, I assembled the major details of the Galileo program in a manner which will hopefully help others to understand the history to date of the Galileo program. I was not able, despite my efforts, to penetrate deeply behind the scenes or bring to light new information about the hard bargaining and negotiations that occurred leading to these decision points. Therefore, I was unable to assess the possibility that there was a hidden agenda behind the publicly released expressions of policy concerning the Galileo program. I took such expressions of policy at face value. However, I found very little evidence to suggest that there was some type of hidden agenda or that there was an overt attempt to conceal or obscure the "true" intent of the Galileo program.[1] In fact, a close examination of the public expression of policy reveals European intentions quite clearly. Nevertheless, future researchers which are able to penetrate to the micro-level and assess what motivated individual decision-makers at specific meetings or other points in time may discover such hidden information and reveal new insights to add to this study. But until then, this study provides a detailed overview of the key decisions and the officially expressed motivations behind those decisions.

In addition, this study shows how realist "power" factors, including security interests, have grown in significance as a motivating force for EC action over approximately the last 15 years. Previously, the EC was mainly concerned with "liberal"

[1] I acknowledge the danger of being accused of creating a strawman argument here, but I think it is fair to say that observers, especially in the U.S. DoD, believe that realist factors have always been by far the most significant drivers of the Galileo program and any European talk about economic or other rationales is often thought of as attempts by Europeans to obscure Galileo's realist purpose – i.e. balancing the United States.

issues involving the European common market, trade issues and common goods. The Galileo program's development paralleled a rising interest in security issues at the EC and in the second pillar of the EU. The EC security interests started mainly at the left end of the security continuum offered in Chapter Three and progressed steadily to the right to eventually include "military" security interests.

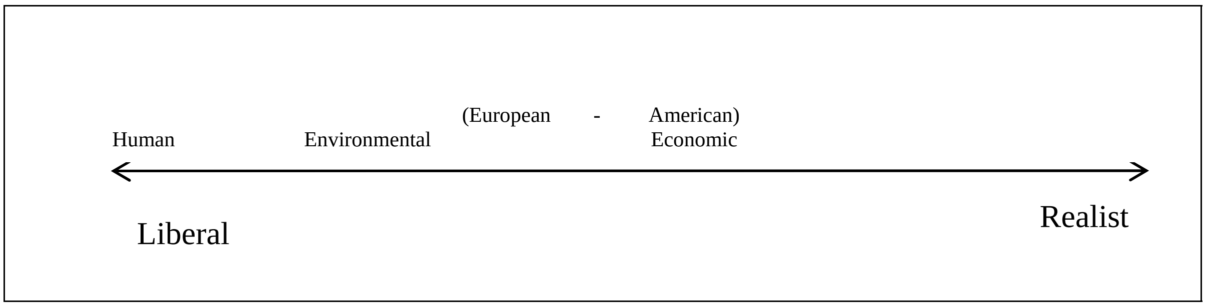

Figure 9: Security Continuum

The history of the Galileo program reflects this shift in emphasis. But the obstacles the Galileo program encountered may also reflect the influence of the EC's traditional interests in providing public goods, bolstering Europe economically, and providing commercial advantages for its industry. Perhaps the obstacles the Galileo program encountered are reflections of the struggle between old rationales and new rationales for wider EC priorities and actions. If so, the Galileo program may serve as a useful indicator of broader EC priorities and interests. Judging by the Galileo program today, it looks today like realist factors may have found a new, firmer prominence in the EC.

The Galileo program may also serve as an indicator of the EC's interest in space activities in general. After years of delays due to the commitment to structure Galileo as a PPP, the 2007 decision to invest billions of EC public funds in the Galileo program may indicate that the EC now has the political will to assert itself as a space power, rather than

leaving it to ESA or the private sector to take the lead in space for Europe. Even though ESA remains the premier space organization in Europe, tying ESA's activities to broader EC interests, as demonstrated by Galileo, may indicate that a new era has dawned in the European space sector. If so, this may have implications as a source of both more cooperation and competition for the United States, Russia, China, and other space faring nations.

The Galileo program's travails also call into question the usefulness of the PPP management and funding mechanism for large scale, risky, public infrastructure projects. The EC's ability to manage such an arrangement is also in doubt. Instead, the Galileo experience reinforces the need for public funding and strong political commitment for such a major project. Nevertheless, the research conducted for this study does not support the belief by some observers that the use of the PPP approach was a transparent political ploy or political cover to gain United Kingdom and German support at the first two decision points. The experience of the 1990s showed that the PPP approach was viable and it was used successfully in many major infrastructure projects and space endeavors. In addition, DG TREN remained committed to the PPP approach even after it caused years of delays and rising costs. If the PPP approach was simply a political tactic, it was a very expensive scheme indeed.

The Galileo program also illuminates the practical challenges and theoretical complexities engendered by the growth of multi-use technologies. The blurring of the lines between commercial, civil, and military capabilities makes it difficult to assign development, management, and funding responsibilities for such projects and presents international relations scholars theoretical challenges when attempting to categorize such

capabilities. Galileo illustrates how such fungible capabilities complicate the theoretical understanding of such projects. Likewise, Galileo illustrates how public-private partnerships also blur the line between private interests, security interests, and civil interests. A thorough examination of these issues by future researchers may reveal useful insights about how such capabilities may best be assessed.

This study considered the risk of Galileo program termination in 2002 and 2007 as legitimate. However, a more skeptical view may ask if the risk was real. In 2002 and 2007 the civil and commercial rationales for Galileo were insufficient for a decision to go forward. Pressure from top European leaders as embodied in the European Council, and from military actors in 2002, was able to overcome these fundamental issues (although not quickly or easily). The use of public money to fund 100 percent of the Deployment Phase demonstrates that in 2007 European decision-makers would not let Galileo be terminated. This may indicate that realist "power" motives were driving Galileo all along.

This possibility leads to questions about this study's methodology. Were the methods and analytical categories used in this study useful? Given that scholars have productively used very similar multi-mode, multi-level approaches previously, I argue that it was useful. However, I also acknowledge that my application of the approach was unique and the weight given to various factors was subjective. For example, this study narrowly defined the realist perspective to stress its focus on military and defense material capabilities. It also heavily discounted the value of the terms "autonomy," "independence," and "strategic" as realist indicators. This study stressed more concrete evidence of realist motives. If future researchers measure those terms as strong realist indicators, as they commonly are considered, the findings for the 1999 decision point

may be different. Realist factors might be found to have been the most significant influence on European decision-makers in 1999. However, it is interesting to note that even after discounting heavily the value of those terms, this study still found that realist factors dominated at the 2002 and 2007 decision points.

The events outlined in the study above show that the European quest for a collective, civil satellite navigation system has been underway in one form or another for nearly forty years. During that time, a complex mixture of rationales has provided the motivation for this endeavor, but up until now, none have bore fruit. Time will tell if the shift in relative weight from more liberal rationales to more realist rationales will finally get Europe to this destination.

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